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Handling Ore at Copper Queen Mines, Bisbee

Ore Is Hauled, in Cars with Automatic Couplers, by Electric Motors, Hoisted in Skips and Loaded into Railroad Cars by Belt Conveyers

BY WALTER GARDNER*

The Copper Queen Consolidated Mining Company has recently introduced new methods of handling the ore at its mines at Bisbee, Arizona. Formerly, the small mine cars having a capacity of 13 cu.ft. were trammed by hand or hauled by mules to the shaft stations of the various mines, hoisted on two- or three-deck cages to the surface, and dumped into railroad cars from elevated loading stations; all of this entailed a comparatively high labor cost. The present system includes electric haulage underground and the transfer of the ore to railroad cars by means of belt conveyers, thus reducing the rehandling of ore to a large extent by the substitution of mechanical methods for hand labor, though mule haulage and tramming are not entirely eliminated. Instead of hoisting the ore from each mine through its respective shaft, the entire output is hauled to a main hoisting shaft, the Sacramento, in trains drawn by electric locomotives. Electric haulage is installed on alternate levels beginning at the 400-ft. down to the 1200-ft. level, the levels being 100 ft. apart.

The ore from the stopes above the 300-ft. level is drawn off into cars which are assembled into trains and drawn by mules to chutes, where the ore is dropped to loading stations on the 400-ft. level. From the 200-ft., main chutes extend directly to the 400-ft. level. The ore from stopes between the main haulage levels is handled in a similar way. All chutes are provided with gates of the arc type, made of ¼-in. steel plate. These not only allow easy control of the flow of ore, but in case of clogging in the chute they may be swung back out of the way, permitting free use of a bar to pry loose the obstruction. On the haulage levels the ore is run into self-dumping, side-discharge cars of the "gable," or "A" bottom type, built by the Arthur Koppel Company The body of the car is 4 ft. 8 in. by 2 ft. 6 in. by 2 ft. 9 in. deep, and has a capacity of 21 cu.ft. The over-all dimensions are 6 ft. 4 in. by 2 ft. 8 in. by 3 ft. 10 in. high. The gage of the wheels is 20 in. and the wheel base is 21 in., so that curves of 15 ft. radius can be passed. The couplings are of the automatic type.

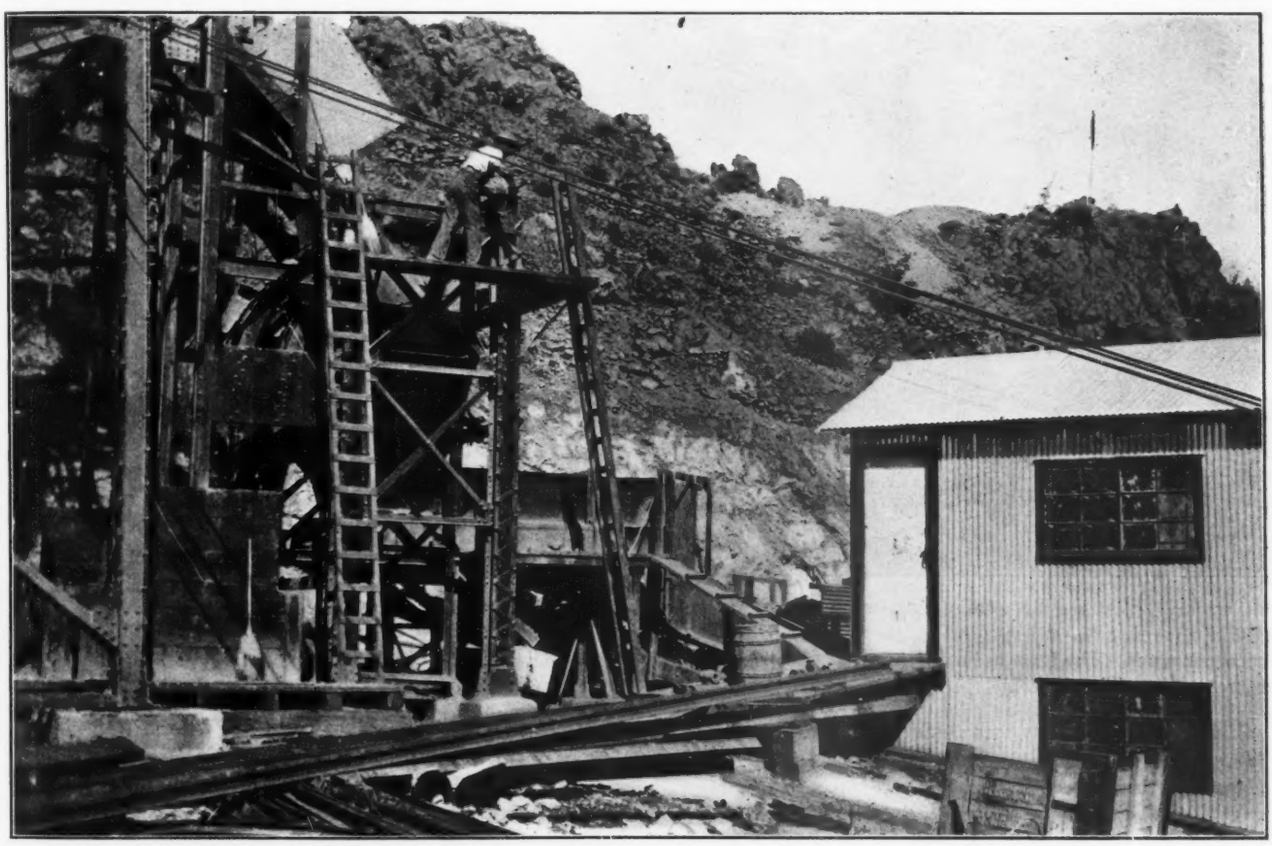

FIG. 1. SKIP DUMPING AT SACRAMENTO SHAFT. FEED CHUTE TO CONVEYER SYSTEM ON LEFT

At the main loading stations a double track and switches are provided. After loading, the cars are made up into trains; the length of the trains varies on the different levels, according to the conditions of grade, but the average haul is about 12 tons of ore to the train. The

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trains are drawn to the Sacramento shaft by the Goodman electric locomotives at a speed of approximately six miles per hour. The over-all dimensions of the locomotives are 8 ft. by 2 ft. by 2 ft. 9 in. high; the wheel base is 24 in. The motor takes direct current at 250 volts from a trolley wire hung 6 ft. 6 in. above the center of the track. In untimbered workings the wire is suspended from 4x6-in. sprags; these are 3 ft. 6 in. long, supported by two 1-in. bolts let into the back of the drift and they are placed about 50 ft. apart in the straight drifts; around curves they are placed closer together to keep the wire in the center of the drift. The track is of 32-lb. steel laid on 4x6-in. ties; the rails are well bonded together by copper wires. The least radius of curvature employed is 25 feet.

The hoist itself, built by the Nordberg Manufacturing Company, is of interest as it is the first of its type to be installed in the district. It is a tandem-compound, condensing, direct-acting hoist having 16x24x48-in. cylinders. The drums are 7 ft. in diameter and have 60-in. faces so that they are capable of carrying 2100 ft. of 1¼-in. round rope in two layers. The steam is generated in a central power house, situated nearby, from Stirling boilers equipped with Foster superheaters and Greene fuel economizers. It is at this power house that the electricity for the haulage system is generated. By means of rotary transformers the direct current for the mechanical traction is obtained by stepping down and transforming current at 2200 volts that is generated by Curtis vertical turbines. The economy of this central plant and of the type of hoist employed are large factors in reducing the cost of handling the ore, as the work of the simple, non-condensing hoists at the various shafts is now confined to hoisting and lowering men and timbers; the "dinkey" hoists, formerly used for this purpose, are now unnecessary.

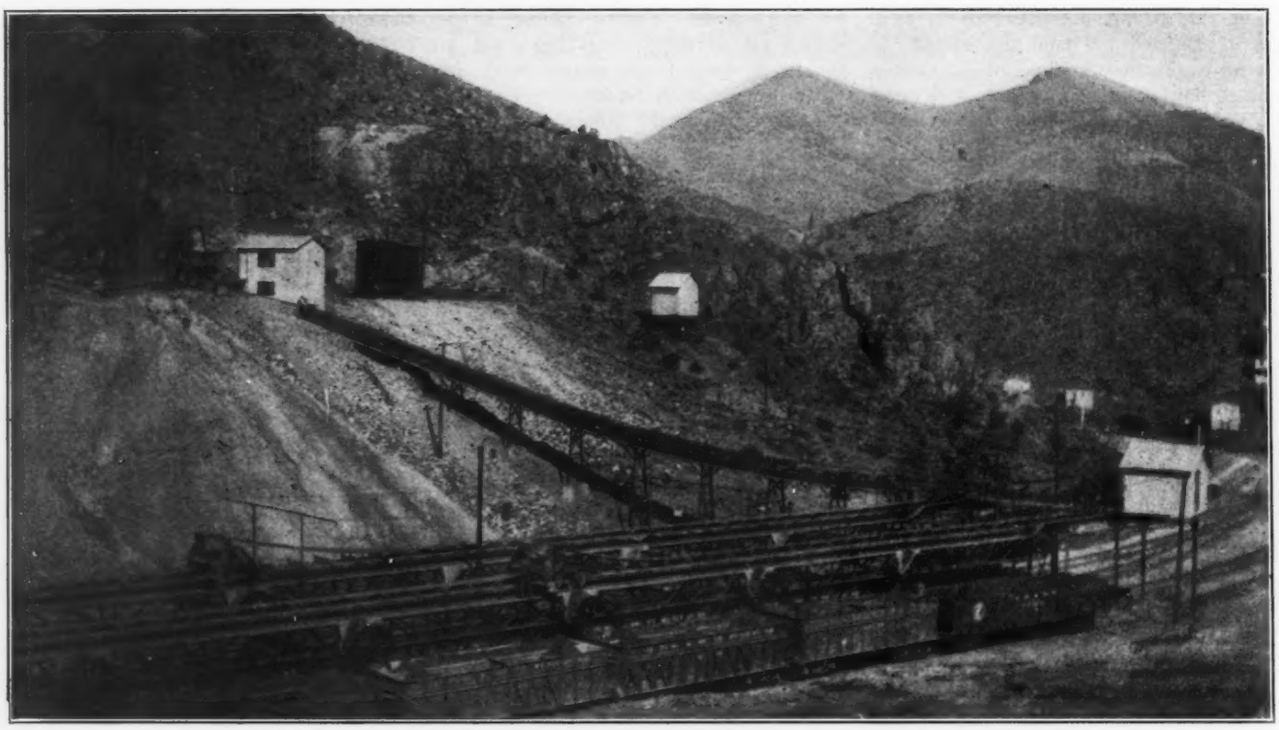

FIG. 2. CONVEYER SYSTEM FOR LOADING ORE TRAINS AT COPPER QUEEN MINES

Handling the Ore in the Shaft

On the arrival of a train at the Sacramento shaft the side doors of the cars are released and the ore discharged into pockets below the station. The train of empties then returns to the main track by a loop passing around the shaft. These ore pockets, which have a capacity of 50 tons, terminate in two chutes for loading the skips in which the ore is hoisted through a vertical shaft to the surface. In order to prevent overloading, the proper amount of ore for one hoist is determined by means of a measuring box, placed below the ore pocket proper. The skips have a capacity of 60 cu.ft. and are self-dumping. They are built of ½-in. steel plate and were constructed at the company's machine shop.

Handling the Ore at Surface

When hoisted to the surface, the skip automatically dumps its contents into a steel hopper at the base of the head frame (Fig. 1). The ore is carried from the hopper to the first of the belt conveyers by means of a short steel link conveyer, the drive of which is synchronized with the speed of the belt. As may be seen in the accompanying illustration (Fig. 3), the belt-conveyer system consists essentially of a cross conveyer delivering the ore to one of two loading conveyers; these latter belts are approximately at right angles to the first and run on a light steel trestle above and parallel to the railroad tracks. The cross conveyer is 240 ft. long; the loading conveyers are each 330 ft. long; all the belts are 30 in. wide and are driven by electric motors. The ore from the short link conveyer is fed by means of a suitable chute or spout to the cross conveyer, which carries the ore down to the railroad tracks, passing through the light building near the headframe shown in Figs. 1 and 2. This building is the scale house and contains a Blake-Dennison scale which automatically weighs and records the amount of ore carried by the belt. By means of a tripper the ore may be delivered at will to either of the two loading conveyers. The railroad cars, having a capacity of 50 tons each, are drawn up in trains of ten cars on either side of the belt, which discharges the ore into them by means of a tripper traveling along the belt. This tripper is self-reversing; as soon as it reaches the end of the conveyer it automatically stops and begins to travel in the opposite direction. The spaces between the cars are bridged by inclined spouts, so that no ore falls between. In this way the ore is evenly distributed over ten cars and the contents of the tenth car may be taken as a sample of the train load. Suitable provision is made for switching loaded cars and empties, and ample accommodation is made for further strings of cars while waiting to make up a train to carry the

ore to the smelter at Douglas. With a view to possible needs in the future, the belt-conveyer system, which was built by the Stephens-Adamson Manufacturing Company, is designed to handle 3000 tons per day, although the present output is considerably less than this amount.

Determination of Silver in Gold Bullion

E. H. Taylor (*Journ.* Chamber of Mines of West Australia, July 31, 1908), describes the method in use at the Great Boulder Perseverance Gold Mining Company, Ltd. mine for the determination of silver in gold bullion. The method involves the fusion of the bullion with metallic cadmium, solution of the fused alloy in nitric acid and titration of the silver in the solution with ammonium sulphocyanate. The method, although not a new one, does not seem to be generally known. The author claims that the amount of copper present in a bullion 900 fine in silver and gold does not interfere with the delicacy of the end reaction.

A standard solution of ammonium sulphocyanate is made by dissolving 1.6 grams of the pure salt in 1000 c.c. of distilled water. The solution is standardized against pure silver foil, 1 c.c., approximately, equaling 4.483 parts of silver per 1000. A check piece of bullion containing, approximately, the same amount of silver as that to be assayed, is fused with cadmium and treated in exactly the same manner as the assay.

A preliminary fire assay is first made to determine the amount of silver to be used for the check piece. Then 0.5 gram of the bullion is fused in a porcelain crucible with 1.5 grams of cadmium under a cover of potassium cyanide. The fusion period is about five minutes with an ordinary lamp during which time the cadmium must be completely covered with the cyanide. The fusion is allowed to cool, the cyanide dissolved away with a stream of running water, and the clean ball of alloy placed in a flask.

The alloy is covered with 20 c.c. of water and four successive additions of 10 c.c. portions of nitric acid are made. During the addition of acid the solution is kept boiling and the boiling continued for an hour. The solution is then diluted with water to 150 c.c., 10 c.c. of ferric alum indicator added, and the silver titrated with the standard ammonium sulphocyanate. To lessen the time consumed in boiling, the buttons may be allowed to digest over night with 10 c.c. of nitric acid.

Ore Treatment at the Giant Mine, Rhodesia

SPECIAL CORRESPONDENCE

In the November *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, Reginald C. H. Cooke contributes an interesting description of the reduction plant at the Giant mine. The process used is remarkable, owing to the absence of a cyanide plant. The gold is caught by amalgamation and on blanket and canvas tables. The ore is a heavily mineralized chlorite schist, intermixed with a good deal of ironstone and quartz, and the following is a representative analysis:

	Per Cent.
Iron as Fe_2O_3	18.0
Magnetite	14.0
Pyrite	14.6
Insoluble silica and silicates	46.0
Al_2O_3	6.0
Total	98.6

Specific gravity = 3.1.

The gold is of two kinds, (a) bright yellow gold, 30 per cent.; (b) refractory, of rusty appearance.

A very coarse screen is used in the battery, and consequently a large tonnage is put through—about 15 tons per stamp per 24 hours. There are 15 stamps, each weighing 1250 lb. In two batteries ⅜-in. screening is used, and in the third ½-in. screening. The reason given why ½-in. screening is not used in all batteries is that the ore crushed would then exceed the capacity of a single tube mill. About 30 per cent. of the gold is caught on the plates which are 4 ft. long and which are not injuriously affected by the coarseness of the material passing over them.

The following table shows the different results obtained as ⅜-in. mesh, or ½-in. mesh is used. The difference between Nos. 1 and 2 is due to the position of the grizzlies, No. 2 battery receiving most of the fines.

	Battery No. 1, ⅜-inch Mesh Screening. Per Cent.	Battery No. 2, ⅜-inch Mesh Wire Screening. Per Cent.	Battery No. 3, ½-inch Mesh Screening. Per Cent.
+ ⅜	.....	.....	3.12
+ ½	2.50	0.62	7.22
+ ⅝	7.38	5.62	10.22
+ ¾	6.15	5.00	8.00
+ 30	25.00	22.50	25.00
+ 60	12.50	13.78	12.45
+ 90	8.19	10.00	7.75
+120	5.00	5.62	5.21
—120	30.78	36.00	20.00
Total..	97.50	99.14	98.97

The pulp on leaving the tables flows through amalgam traps and then into a table-mill dewatering spitzkasten 4x4 ft. The coarse goes to tube mills which are 25 ft. long and 5 ft. in diameter, lined with silex blocks, which last 31 weeks. The discharge from the tube mill contains 87 per cent. less than 90 mesh.

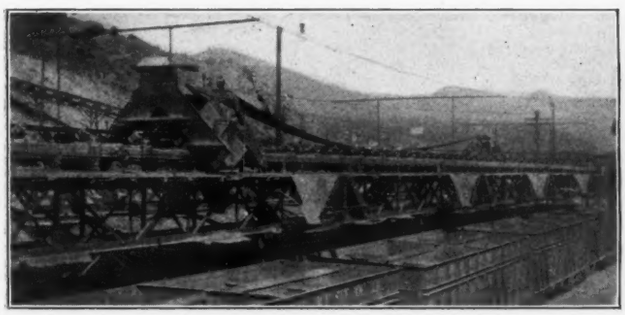

FIG. 3. CONVEYER SYSTEM FOR LOADING CARS, COPPER QUEEN MINES, SHOWING THE TRIP

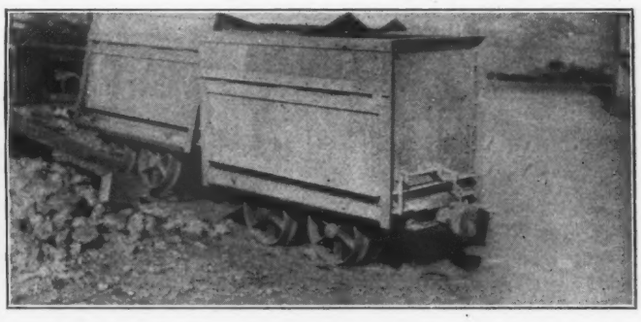

FIG. 4. ORE CAR WITH AUTOMATIC COUPLING, COPPER QUEEN MINES

The pulp from the tubes passes over blanket tables, consisting of 12 strakes—two of which are spares—12 ft. long by 2.5 ft. wide with a 12.5-per cent. fall. About 55 per cent. of the gold is recovered from the blankets, which are washed at short intervals, the frequent washing being considered an important feature. About 4 to 5 tons of concentrates are won per day, which are reconstructed on another blanket table until about half a ton of rich concentrate is obtained. This concentrate is treated in an amalgam barrel with about 300 c.c. of concentrated HNO_3. The acid cleans the gold and renders it amenable to amalgamation.

The total extraction averages 87.7 per cent., the tailings carrying about 1 dwt. The costs are about $1.20 per ton, but may be reduced from 6c. to 12c. per ton.

For the year ended June 30, 1908, on a total of 65,068 tons worked, the costs of all departments were: Mining, $1.24; milling, $1.30; sorting and crushing, $0.24; general charges, $0.48; mine development, $0.44; total, $3.70 per ton.

Richards Pulsator Jig and Classifier

A New Principle in Ore Dressing, That of a Current of Water Pulsating Rapidly in a Single Direction, Applied to the Jig and the Classifier

BY FRANK E. SHEPARD*

Dr. Robert H. Richards, the eminent author of "Ore Dressing," has for many years conducted exhaustive experiments for the purpose of determining the action of ore particles in bodies or currents of water and the results of these investigations form the subjects of various papers in the *Transactions* of the A. I. M. E., *The Mineral Industry,* and many technical papers. Particular attention has been given to practical devices for improvement in the jigging of ores and the hydraulic classification of ore pulps, previous to concentration.

The climax of all this great work is embodied in two remarkable devices, one, the Richards pulsator jig for the concentration of the coarser ore particles, and a machine separate and distinct from the jig, known as the Richards pulsator classifier, which effects a hydraulic classification of the finer ore pulps, previous to wet concentration.

The Richards Pulsator Jig

The field of the hydraulic jig is found in the concentration of ores in which the mineral occurs wholly or partially in comparatively coarse particles. For many years jigs have been most successful in the treatment of coarse products and they are also efficient in the concentration of fine pulps; they are sometimes, though rarely, used for slime products, but commercial practice seems to place the limit of the smallest advisable pulp particle for jig treatment at 1 mm., or about 12 mesh No. 19 wire.

Heretofore, jigs have been designed along two general lines: (1) Jigs with movable sieves, which produce the hydraulic currents by pushing the screen up and down in the water. (2) Jigs with fixed screens in which the hydraulic currents up and down through the screen are produced by a plunger, actuated by eccentrics, tappets or other mechanical equivalents.

In both these types of jig the concentration of the mineral portions of the ore is effected by an upward and downward current of water alternating with each other and acting upon a bed of the ore particles supported on a wire screen, having openings depending on the size of the ore particles treated. During the upward movement of the water called "pulsion," through the screen aperture, the various ore particles arrange themselves according to their specific gravities, those of greater specific gravity arranging themselves in the lower strata just above the screen, while the particles of lesser specific gravity are found in the upper strata, farthest from the screen. During the downward movement of the water called "suction," ore particles possessing a greater specific gravity are drawn downward through larger particles toward and sometimes through the screen.

The valuable mineral portions of the ore are usually of a high specific gravity and thus settle down on the jig screen and are sometimes drawn off from above the screen by means of a device known as a "cup discharge," or under certain conditions are drawn down through the jig screen into that portion of the machine known as the "hutch," and giving a concentrated product called the "hutch" product. The tailings, or ore particles containing little or no value, being of less specific gravity, are found in the upper strata, most remote from the jig screen, and by various designs of gates are discharged from the jig.

This suction portion of the water current, while serving as a benefit under certain conditions, proves a serious defect in the successful continuous operation of the jig, on account of the "blinding" of the jig screen, caused by ore particles being drawn into the screen opening during the suction cycle of the water current. This suction also tends to pack tightly the layers of high specific gravity just above the screen, and thus tends to prevent a free arrangement of the ore particles, which is absolutely necessary for a best possible separation of concentrates from tailings.

The jig most generally used in the concentration plants of the world is of the fixed-screen type, known as the Harz jig. The Richards jig has its feed box, screen compartments, concentrates discharge and tailings spout in the same relative positions as found in the Harz jig; it has a hutch for each compartment, of the same general design as found in the Harz; the water current enters the hutch in the same general direction, and, generally speaking, the principles employed in the Harz jig are found in the Richards jig. The distinguishing feature of the Richards jig is in the novel application of a pulsating water current, first applied successfully by Doctor Richards. The hydraulic water is delivered to the jig under a head of about 30 ft., and passes to a special design of rotating valve, which is balanced in all positions. This valve is driven by a 3-in. belt and pulley from any suitable mill shaft which has a fairly constant speed. The shaft driving the concentrating tables will serve. The valve is usually driven at the rate of from 75 to 150 r.p.m., and being double-ported, delivers a water current of from 150 to 300 intermittent pulsations per minute. An air chamber is used in connection with the rotating valve and serves to intensify the action of the water current in the jig. This pulsating current of water is delivered to a manifold equipped with suitable adjustable valves, which serve to increase or diminish the intensity of hydraulic water in any one compartment. Thus we have an intermittent pulsating current of water passing *up* through the screen in each compartment, and not being drawn down through the screen again, as in the Harz jig.

Effect of the Pulsating Current

The effect of this pulsating water current in the treatment of ores in the Richards jig is most remarkable. The four-compartment jig has four compartments, each having a screen area 4x4 in., making a total jigging screen area of 64 sq.in. A jig of this size and type treated Butte copper ores, previously screen-sized through 8-mm. and on 2½-mm. screens, at the rate of 90 tons per 24 hours; the quality of concentrates and tailings meeting the requirements of the system. To accomplish equivalent results with the common Harz jigs would require three double four-compartment Harz jigs having a total screen area of 12,000 sq.in., as compared with 64 sq.in. in the Richards jig; or 1 sq.in. in the Richards system does as much work as about 200 sq.in. in the Harz system.

Following out the comparison we have the following parts requiring attention and lubrication in the Harz system for the tonnage quoted: 6 tight pulleys, 6 loose pulleys, 30 babbitted bearings, 24 eccentrics and straps, or 60 places to lubricate as against one pulley and two bearings in the Richards jig.

A most important discovery in the development of the Richards jig was found in the small amount of fresh water required. The average amount of water required in the Harz system of jigging, as determined from 30 mills in American practice, is 4700 gal. per ton of ore treated. The average amount of water required in the Richards system is only 1000 gal. per ton of ore treated; furthermore, of this 1000 gal. of water delivered to the jig, 500 gal. of perfectly clear water

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Note—From *Proc.*, Colo. Sci. Soc., Vol. IX. A description of these machines and the methods of operation appeared in the Journal of Sept. 26, 1908.

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is discharged with the concentrates and may be returned for use in the mill system. In the Harz jig pulp beds of only 3 or 4 in. depth above the screens are maintained and the layer of concentrates is but 1 in. and often less; while in the Richards jig, ore beds of 12 and 14 in. are maintained and the layer of concentrates is 8 or 9 in. in depth. This greatly increased thickness of the concentrates bed acts as a filter and the water discharged with the concentrates is perfectly clear.

The feature of being able to carry such a deep bed of ore renders the operation of the Richards jig less subject to fluctuations in the ore feed, and having been suitably adjusted for a certain class of ore, the jig will operate hour by hour without any change of adjustment.

In jigs, using the pulsion and suction type of water current, large screen areas are necessary and in many cases artificial beds are required to treat the ores successfully. These large screen areas and the repeated grinding action of the mineral particles in the artificial beds or on the screen wires produces an abnormal amount of rich slimes, which greatly hinders, if it does not absolutely prevent, a successful recovery. In the Richards jig, no artificial bed is required; the jig makes it own bed; and further, there is not any passage of concentrates down through the screen into the hutch, the concentrates being discharged through a gate above the screen. The rapid action, the small screen areas, and the attrition reduced to a minimum, are reasons for reducing the slime losses in the Richards jig, and the sharp edges of the concentrates are a marked contrast to the same product from jigs of large screen areas with hutch products.

Field of Operation

The field of operation for this Richards jig will be the treatment of any possible jigging ores in any screen-sized product from ½ in., possibly as large as 1 in., down to 1/32 in. in diameter. Commercial practice seems to place the lower limit of jig feed sizes at 1 mm., corresponding to about 12-mesh No. 19 wire. Any mill pulps finer than this may better be treated on shaking tables or belt vanners, if properly classified previous to concentration.

Two and three mineral separations may be made under reasonable conditions of jigging. Recent tests have proved that the Richards jig will successfully separate slate and refuse from good coal, which fact opens a wide field of operation, with great possibilities in a marked saving in clean coal, as well as a great improvement in the cokes manufactured from washed coal. Tests made at the Government coal-testing plant, on Illinois and local bituminous coals, indicate that the 4-in. four-compartment size will treat such coal at the rate of 70 tons in 24 hours.

Statistics show that of the refuse thrown away in prevailing coal-jigging methods, from 10 to 50 per cent. is good coal. Tests made on the Richards jig indicate that a loss of good coal in the refuse of less than 5 per cent. may be realized.

This system of concentration for coarse ore products has developed not only a remarkable efficiency in the jigging system itself, but has created great possibilities in the economy of attendance, size of plant, power and water required. The Richards jig has been found to be automatic under working conditions and even with an irregular feed will still continue to deliver for hours a satisfactory product without any change in adjustment.

Capacity

The 4-in. four-compartment Richards jig, when treating Butte copper ores, carrying from 2.5 to 3.5 per cent. copper, recovered 37 per cent. of the copper in the feed at the rate of 90 tons in 24 hours. The concentrates are of a grade suitable for delivery to the copper smelter; the tailings are reground for subsequent table and vanner work. This means that 1 sq.in. of screen surface in the Richards system treats 1.4 tons of ore in 24 hours.

Reports of a 4-in., six-compartment Richards jig operating in Rico, Colo., on a difficult ore composed of galena, iron sulphides and zinc blende, gave a lead product of 76.7 per cent. lead, with only 3 per cent. zinc.

A 4-in., four-compartment Richards jig operating commercially on a lead ore carrying about 10 per cent. in the crude, in Boulder county, delivered a 60-per cent. lead product.

Numerous tests have been made on a 2-in., four-compartment Richards jig at the testing plant of Henry E. Wood & Co., Denver, Colo., and the results from a great variety of ores prove that good commercial results may be accomplished on this laboratory size, having only 16 sq.in. of screen surface.

The Richards Pulsator Classifier

Following the concentration of coarse ore products by jigs, is the recrushing of the jig tailings and often the jig middling products by means of rolls, stamps, tube or roller mills. Various forms of hydraulic classifiers have been used to grade these recrushed pulps into different classes previous to their being delivered to tables or vanners, but the results have been far from satisfactory. In cyanide systems it becomes necessary to make a good separation of slimes from sands, and in tube milling the delivered product is usually classified previous to being delivered to the leaching or agitation systems. A study of Doctor Richards' "Ore Dressing" will show the types of hydraulic classifiers which were designed in the long search for a successful system and the argument for classification previous to table and vanner work is ably presented in Doctor Richards' paper entitled "The Wilfley Table," *Trans.*, A. I. M. E., 1907 and 1908. Even now we find advocates of a mixed feed for good concentrating table work, and it is difficult to understand how such practice prevails, when test after test shows marked advantages due to a proper grading of ore pulps before table work.

The Richards pulsator classifier overcomes the difficulties found in the older forms of hydraulic classifiers and delivers a quality of pulps to tables which not only admits of greatly increased capacity, but improves the quality of work performed. Screen-sized pulps show a great improvement in table or vanner work when compared with an untreated or mixed feed, but there are so many mechanical difficulties attending the use of fine screens that the maintenance of such a plant becomes a serious factor in milling operations.

In the Richards classifier, the mechanical moving parts have been reduced to a minimum and the adjustments are simple, while the saving in space occupied is a marked advantage. The classifier consists of six compartments, all 4 in. wide and varying in length. This classifier delivers six graded pulps varying from the finest, which issues from the first and highest discharge gate, to the coarsest grade which issues from the last and lowest discharge gate. The same types of pulsating valve, air chamber, manifold, adjustable water valves and hutch are found as in the Richards pulsator jig.

Nearly all the old forms of hydraulic classifiers are modifications of the Rittenger type, called spitzkasten, in which classification is accomplished by a change in the velocity of the current of water carrying the ore. The pulp is fed to the first compartment, an inverted pyramid, having the smallest cross-section. The first compartment has a sectional area much larger than the launder delivering the pulp, hence the velocity of water current is reduced, with the result that the heavier particles of ore settle to the bottom of the compartment, where they are drawn off for treatment. The succeeding compartments of the classifier have a greater and greater cross-section, hence there is accomplished a further decrease in water currents with a resulting settling of finer and finer ore particles until the finest slimes pass out of the last compartment. The pulps delivered by these various compartments consist of small particles of mineral and larger particles of gangue material, equal-falling particles in water and diameters depending on the specific gravity of the particle. For example, a particle of galena 1 mm. in diameter falls in water with a quartz particle whose diameter is 3½ mm. If a concentrating table were fed with such classified pulps the result would be

a great improvement over the mixed feed, but the form of the spitzkasten is such that eddy currents are set up and the discharge of the partially classified pulp establishes more currents and the result is that fine slimes are delivered with the coarse pulps.

In screen sizing the attempt is made to deliver mineral and gangue particles of the same diameter or cube. But here again through imperfect washing, or insufficient screen area, a large proportion of slimes is delivered with the coarse pulps.

The Richards classifier is so designed and operated that the fine slimes are delivered from the first one or two discharge gates, leaving the coarse pulps clean and free from fine slimes to discharge upon the concentrating tables with practically clear water. It is often possible to catch from the last discharge gate a sample of pulp which will settle to the bottom of the sample dish, leaving the water clear.

Advantage of Classification

If for purposes of illustration we assume fed to the Richards classifier a simple ore composed of galena and quartz, all the discharge gates will deliver a product in which the galena particle is one unit in diameter, while the diameter of the quartz particle issuing from the same compartment, will be 6½ times that of the galena particle. The first compartment will discharge the fine slimes and the last, or sixth compartment, will discharge the coarsest particles, but from every compartment the quartz particle is 6½ times the diameter of the accompanying galena particle.

Suppose these pulps are fed to any of the well known concentrating tables or vanners—with the pulps from the old form of classifier known as spitzkasten, the small diameter of mineral particle lies on the table surface in the lower strata of wash water, where the velocity of wash water is the least, owing to its retardation due to friction between the water and the table surface. The quartz particle being 3½ times the diameter of the galena particle, projects farther up into the stream of wash water where the velocity of water current is greater; the quartz particle also presents an exposed area of more than 12 times the exposed area of the galena particle; consequently the quartz particle is washed down with the water current, leaving the galena particle to travel on to the concentrates box. Unfortunately the spitzkasten delivers with the coarse pulps, a slime product which does not belong with the coarse pulp, and the result is that a wash-water current suitable for the coarse mineral particle will be too violent for the slime particle and the slime value is washed away with the tailings and lost.

Suppose a screen-sized pulp is delivered to the concentrates surface. The mineral particle is the same diameter as the gangue particle; they both project up into the wash-water stream the same vertical distance; the areas exposed to the wash water are the same, and we have only one property, the greater weight of the mineral particle, which tends to retard it and allow the gangue particle to wash away to the tailings discharge. It is easy to comprehend how the classified product, with its small particle of mineral and its large diameter of gangue particle will produce a more positive separation.

Now suppose we deliver the pulp from the Richards classifier, the product from which gives, for example, a galena particle one diameter and a quartz particle 6½ diameters; then we have a quartz particle with an exposed area 42 times the exposed area of the galena particle. Note that the ratio between the diameters of galena and quartz particles of the pulp delivered by the old form of spitzkasten is 1 to 3½; whereas the ratio between the diameters of galena and quartz particles of the pulp delivered by the Richards classifier is 1 to 6½. In other words, the quartz particle delivered by the Richards classifier is nearly twice the diameter of the quartz particle delivered by the old form of spitzkasten, and presents more than three times the exposed area to the current of wash water.

Practical Results

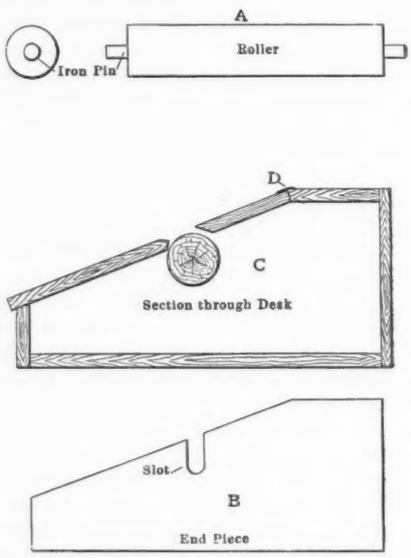
This very important point of increasing the ratio of equal settling grains allows a most interesting use of fine screens as concentrators. The Richards pulsator classifier makes it possible to select a screen of such opening that the mineral particle will fall through the screen, thus making a concentrate, while the larger gangue particle passes off as tailings. Sometimes a middling product is produced from Richards classifier pulps which carries large mineral particles and small gangue particles. In this case the screen may be selected to deliver the mineral as an oversize, while the gangue particle being smaller, drops through the screen. Both the results mentioned have been accomplished in actual milling operations.

Heretofore it has been considered that concentrating tables should not treat pulps coarser than 1 mm. or about 12-mesh No. 19 wire. In one instance a copper-ore pulp as coarse as 2.5 mm. was successfully treated on a concentrating table, with greatly increased capacity and improvement in quality of work as compared with former methods. It is not advisable, however, to treat a pulp as coarse as this on shaking tables, on account of the increased wear of the table surface.

The maximum capacity of the 4-in., six-compartment Richards classifier when treating thickened pulps is, from present knowledge, 180 tons per 24 hours for copper ores and 200 tons per 24 hours for lead ores. The fresh water required is from 1000 to 1200 gal. per ton of ore treated. With a regular rate of feed the adjustments are very seldom changed and the classifier requires no more attention than may be given in the regular rounds of the millman.

Keeping Engine-room Reports Clean

In engine-rooms it is difficult to keep the reports of the daily run clean unless some provision is made to protect the report from becoming smeared with dirt and oil, and so rendered unfit for filing. The desk described by C. L. Greer shown in the accompanying illustrations, taken from *Power*, Nov., 1908, is a handy means of protecting such entry sheets. It consists



DETAILS OF DESK FOR KEEPING REPORT SHEETS CLEAN

of a roller, *A*, large enough to carry the report sheet and an ordinary desk, the top of which is hinged at *D* and which has a slot in the top under which the roller with the report is placed in slotted bearings in the side of the desk. The slot is made narrow so that the top of the desk prevents the hand from touching the paper. The space below the roller can be used for extra report sheets and charts.

The present weight of the Philippine silver peso is 308.64 grains, 800 fine. The minor silver coins—50, 20 and 10 centavos are respectively one-half, one-fifth and one-tenth the weight of the peso, but are 750 fine. The peso first authorized was 416 grains, 900 fine, but it was found that these coins were exported to China for their silver value. To retain the coins in the Philippines it was necessary to reduce their bullion value. The peso contains 246.9 grains fine silver, or about two-thirds as much as the United States silver dollar.

Ontario Mines and Iron Deposits

SPECIAL CORRESPONDENCE

The latest report* issued by the Ontario Bureau of Mines opens with a comprehensive statistical review of the mining and metallurgical industries of Ontario in 1907, the details of which have already been given. The revised figures, however, show some changes, principally under the head of nonmetallic products, bringing the aggregate value of the year's output up to $25,019,373 in place of $24,697,775, as previously stated. This, as compared with $22,388,383, the total for 1906, shows an increase of 12 per cent. In accordance with the practice recently adopted, to admit of a fair comparison between the mineral production of Ontario and that of other provinces where a different method of computing values has been used, the report contains another table showing the production on the basis of the value of the refined metals—the first figures presented being the values at the mines or as smelter products. By this method of computation the "refined value" of the metallic products is given at $28,213,934, which with the nonmetallic values —$10,468,538—makes a total of $38,682,472 for the year.

ONTARIO MINE OPERATIONS

E. T. Corkill, provincial mine inspector, furnishes a report on the mines of Ontario, with detailed descriptions of the operations and condition of the principal gold, iron, copper-nickel and other mines; the mines of the Cobalt district being dealt with in another publication. Arthur L. Parsons treats of the geology of the portion of Thunder Bay district adjacent to the Algoma boundary, his contribution being of scientific rather than practical interest.

THE NIPIGON IRON RANGES

The iron ranges east of lake Nipigon are described in two reports, one by Prof. A. P. Coleman assisted by E. S. Moore, and the other by E. S. Moore. The first deals with the ranges in the Poplar Lodge and lake Wendigokan districts. Practically all the iron formation extending from Poplar Lodge, on the shore of lake Nipigon to lake Wawang, 21 miles inland, has been taken up in claims with the exception of a few breaks and a band of diabase which cuts across the range about 7 miles from lake Nipigon. The earlier found of the iron range outcrops were along the shores of lake Nipigon, where a northern, a southern and a central range were located. The Northern range has a length of about a 1¼ miles running northeastward. It reaches in one place a width of 240 ft. but is seldom more than 50 ft. wide. Both magnetite and hematite occur but the range is too narrow and lean from the admixture of silica and slate to be very promising. The Central range lies 3 miles south of the Northern, and is first seen 1½ miles inland from Poplar Lodge. That part of the region is mostly covered with sand plains and swamp, so that the solid rock does not crop out frequently rendering it difficult to prospect without doing much stripping. A good deal of work has been done in this way, and three diamond-drill holes put down, but undoubtedly much of the range remains covered. The range has a length of nearly 3 miles with a breadth of about ¾ mile in the widest part. There are four known outcrops, one of which has been thoroughly prospected showing a widespread series of bands of iron foundation over a length of ½ mile and a breadth of ¼ mile. The ore is entirely hematite and the associated silica is jasper, often bright red. The Southern range has a length of 7 miles, including interruptions of drift and barren rock, and its greatest width is 500 ft. though generally not more than one-tenth as wide. It is separated from the nearest point of the Central range by ¾ mile of greenstone and schist. This range contains much magnetite and resembles the Northern range, though more extensive and richer in iron. For some miles eastward of the diabase hills which separate these ranges from those farther inland, it is no longer possible to distinguish three ranges. The more important outcrops occur west of lake Wendigokan, and southeast of it near Still lake. In the western area the iron formation is wide and consists of banded jasper and gray slate, but there is much schist in portions of the range. The length exposed is about ½ mile. The Still Lake area is a little shorter, but has a width of 450 ft. in the middle, part of it, however, being hidden by drift. The iron range is here very silicious, the last assays of samples running from 35.75 to 36.86 per cent. of iron. Farther to the east are two narrow parallel bands of the iron formation, the longer of which runs from the northeast end of Watson lake for nearly 2 miles with a maximum width of about 100 ft. The iron-bearing rock consists of magnetite and jasper with green slaty schist on each side. The richest specimen of magnetite collected from it runs 48.9 per cent. iron. The general character of these outcrops resembles those of the Northern and Southern ranges near Poplar Lodge, always containing more or less magnetite, yet with some hematite and jasper. The materials of the iron formation in the Nipigon region are always silica in some form, and an oxide of iron, magnetite or hematite, never siderite nor sulphides as in the Michipicoten region. There are two types of the formation, one consisting of interbanded quartzite or cherty silica with magnetite, the other of jasper with hematite, but there are mixtures of the two in many places.

THE ONAMAN IRON RANGES

E. S. Moore's report deals with the Onaman iron ranges, occurring in the vicinity of the Hight of Land east of lake Nipigon near the headwaters of Johnson creek and Red Paint river. Little was known concerning the geology of this region until survey parties for the Transcontinental railway began work through northern Ontario, and a number of prospectors entered the field. During 1906 a considerable iron range was located for R. H. Flaherty, whose success attracted others, most of whom were unsuccessful. There are two distinct iron ranges and some scattered outcrops of the iron formation in this region. One of these ranges extends from the twelfth portage on the Red Paint river eastward across the Hight of Land and down Johnson creek for a distance of about 6 miles. The range is not represented by continuous outcrops, and the strike of the formation in different places varies on account of irregularities in the folding of the sedimentary rocks, caused by the massive igneous rocks associated with them. Since the iron formation lacks the great troughs formed by folding of thick strata of sedimentary rocks, it will probably prove shallower here than in other regions where schistose and sedimentary rocks are abundant. There seems to be one syncline extending along the north side of the range on the Miller claims. If any ore is found in this range it may be looked for in this syncline and a short distance north of the southern edge of the range.

The other range occurs between 2 and 3 miles south of the first, running nearly parallel to it. It has not been traced to its limits, but it is exposed for 2 miles and then runs into a swamp, where its extension can be followed by means of the dip needle. The rocks and iron-bearing minerals of the formation in these ranges are slate, green schists, jaspilyte, specular hematite, magnetite and silica. The report gives an account of some of the development work done on the ranges and isolated outcrops, but so far the discoveries appear to have been of slight commercial value. On the Bain claims, about three miles south of the Hight of Land portage, stripping and trenching have disclosed a formation having magnetite and specular hematite contents, which in some cases form a sufficient percentage to make low-grade ore.

THE IRON AND STEEL INDUSTRY

The concluding portion of the volume consists of a paper by George C. Mackenzie on the "Iron and Steel Industry of Ontario," giving a large amount of statistical information both as to the mining and metallurgical departments, with data as to the iron ores and producing mines, which will be found comprehensive and

*"Seventeenth Annual Report of the Ontario Bureau of Mines, 1908." By Thomas W. Gibson, Deputy Minister of Mines. Pp. 356; illustrated; 9½x6¼ in., paper. Toronto, 1908: Government Printing Office.

valuable. The problem of the magnetic concentration of iron ores is dealt with at length, and descriptions are furnished of the best known and most successful types of magnetic separators. In the course of his investigations the writer visited a number of large plants in the United States, obtaining at first hand information as to the methods of magnetic concentration in operation. In order to show that low-grade Ontario magnetites are amenable to concentration by means of the electromagnet, and with the view of ascertaining the per cent. of separation efficiency that might be expected in actual commercial operation, samples of ore were obtained from various localities in the province and submitted to preliminary testing in the mining laboratory of the Kingston School of Mines. The tests do not appear to have been conclusive, some of the ores requiring finer grinding than that to which they were subjected, but the results pointed to the conclusion that the concentrates obtained from the ores experimented with would require either nodulizing or briquetting before they could be used for smelting purposes. An elaborate description of the iron and steel plants of Ontario and the various processes in vogue is given.

The Rare Metals X—Zirconium

By Charles Baskerville*

Zirconium is allied to titanium and is rather widely diffused in igneous rocks. Zirconium compounds are almost always present in nepheline syenites.

ZIRCONIUM MINERALS.

	Zirconia Content.
Zircon, zirconium silicate	61–67%
1. Compound zircons:	
(a) Eudialyte, a complex zirconium silicate	11–17%
(b) Eucolite, a complex zirconium silicate	12–16%
(c) Polymignite, a niobate and zirconate of cerium, etc	30%
2. Gem varieties:	
(a) Azorite, zirconium silicate	64%
(b) Hyacinth, zirconium silicate	64%
(c) Zirconites, zirconium silicate	61–67%
(d) Jargons, zirconium silicate	64–66%
3. Altered zircons:	
(a) Cyrtolite, containing yttrium earths, etc	41–67%
(b) Anderbergite, related to cyrtolite	41–42%
(c) Malacone containing various metallic oxides	60–63%
(d) Tachyaphaltite, containing rare earths	40%
(e) Oerstedite, containing titania, etc	69%
(f) Auerbachite, almost pure silicate	55%
(g) Alvite, containing large amounts of yttria	4%
Rosenbuschite, a complex silicate	20%
Lavenite, a silico-zirconate of iron, manganese, etc	29–32%
Hainite, a silicate of zirconium, titanium, sodium, etc	.....
Wöhlerite, a silico-zirconate of calcium and sodium	16–23%
Hiortdahlite, a silico-zirconate containing fluorine	22%
Catapleiite, a hydrous silico-zirconate of calcium, etc	30–40%
Elpidite, a hydrous sodium zirconium silicate	20%
Arrhenite, a heterogeneous decomposition-product	3– 4%
Sipylite, a niobate of erbium, cerium metals, etc	2– 3%
Zirkelite, a complex zirconate	53%
Baddeleyite, zircon dioxide	96–97%
Tritomite, a fluo-silicate of thorium, cerium, etc	1– 2%
Erdmannite, a mixture of homilite and another mineral	0– 5%
Cerhomilite, an altered homilite	2– 4%

*Professor of chemistry, College of the City of New York.

Zirconia is extracted from zircon, which is mined in large quantities for technical purposes in North Carolina, especially near Green river, Henderson county. Cyrtolite is abundant in Baringer Hill, Llano county, Texas, and the deposits await development.

Zirconia possesses great radiating power and is very refractory. Cylinders of zirconia have been used in the Drummond light instead of lime and magnesia cylinders, and zirconia is in demand for producing refractory compounds suitable for incandescent illumination. With thorium and yttrium, zirconium enters into the manufacture of Nernst lamps, and filaments of zirconium are used in "Zirconium lamps." Zirconia yields with alizarin a color like one produced by chromium material. The use of zirconium nitrate as a food preservative has been patented.

Various zircons are classed among the gems; they often possess beauty and splendor. Transparent, red and brown varieties of zircon are cut and sold under the name hyacinth.

The market is well supplied with zirconium compounds at present.

Zircon

Zircon occurs in square prisms and pyramids, also in irregular forms and grains. It is found in crystalline rocks, especially granular limestone, chloritic schists, gneiss, syenite; also in granite, iron-ore beds, and alluvial deposits. It is one of the earliest minerals to crystallize from the cooling magmas, and the first one among silicates. The luster of zircon is adamantine and the color is colorless, grayish, yellowish, or brown. Its hardness is 7.5, and the specific gravity is from 4.2-4.86. It is brittle, and the streak is white. Zircon usually contains a small percentage of ferric oxide.

Before the blowpipe zircon is infusible, but the red varieties become colorless and the dark-colored varieties are rendered white; some specimens glow and increase in density on ignition. It is not acted upon by salt of phosphorus. Pulverized zircon is decomposed when fused with soda on the platinum wire, and the product gives the orange color characteristic of zirconia when tested with turmeric paper in a dilute hydrochloric acid solution. Zircon dissolves with difficulty in borax to a clear glass. It is insoluble in acids.

As mentioned above, zircons are especially abundant in Henderson county, N. C. Other specimen localities are: Maine, Vermont, Connecticut, New York, New Jersey, Pennsylvania, Colorado and California. Eudialyte and eucolite occur in Arkansas.

Baddeleyite

Baddeleyite is found associated with magnetite, apatite, perovskite, ilmenite, microlite, and zircon in Ceylon and Brazil. It is of variable color, being from colorless to yellow, brown, and finally black, and has a vitreous luster. Its hardness is 6.5, and the specific gravity is 5.5-6.02. The streak is brownish white, sometimes white.

Baddeleyite is infusible, but glows brightly. It reacts faintly for iron with borax. It is insoluble in acids, and is only slightly decomposed by sulphuric acid in the powdered form. It is decomposed by fusion with acid potassium sulphate.

Eudialyte

Eudialyte occurs in tabular and prismatic crystals, also massive and sometimes reniform. Its luster is vitreous, and the color is rose-red, bluish red, brownish red, or chestnut-brown. It is brittle, and the streak is uncolored. The hardness is 5-5.5, and the specific gravity is 2.92.

Eudialyte yields a little water in the matrass. Before the blowpipe it fuses to a greenish gray bead, and gives an intense yellow flame. It is dissolved by borax to a clear glass which shows a little iron. It is easily decomposed by salt of phosphorus; and when oxide of copper is added a chloride of copper flame results. With hydrochloric acid it gelatinizes, and the dilute acid solution imparts a deep orange color to turmeric paper even after the iron in solution has been reduced to colorless chloride by boiling with metallic tin.

Indian Gold Mines

The mines of the Kolar goldfield in Mysore produced 45,314 oz. bullion in January, showing a decrease of 5360 oz. from December, but a gain of 1411 oz. over January, 1907. The bullion reported this year was equal to $842,985, or 40,783 oz. fine gold.

The production of two mines outside the Kolar field—Hutti Nizam's in the Deccan and Dharwar Reefs—was 1717 oz. gold in January, which compares with 1735 oz. in December. The output of these mines for the year 1908 was 21,215 oz. gold against 17,406 oz. in the preceding year.

Safety-catch devices that depend upon their action on the guides for gradually stopping the cage, according to *South African Min. Journ.*, Jan. 16, 1908, have been proved by experiment to be failures because of variations in dimensions of the guides, difference of condition of the timber in the guides, and the loss of equilibrium caused by inequality of brake action on the guides due to these causes.

Ways of Improving Piston and Hammer Drills

Efficiency in Piston Drills Can Be Increased by Using Heavier Steel, a Shorter and Quicker Stroke, Better Lubrication and Improved Chucks

BY EUSTACE M. WESTON*

This paper contains several extracts from my reply to the discussion on my paper "Notes on Small Stope Drills" read before the Chemical, Metallurgical and Mining Society of South Africa, but I have added some new matter and, through the courtesy of Mr. Mauss, its inventor, a description of the Konomax automatic piston drill. In my paper I raised the query as to what in machine drilling is the best ratio of foot-pounds of energy to an inch width of the cutting bit. The South African mines stope-drill contest, an account of which has already appeared in this JOURNAL, seems to show that in piston machines this ratio may be with advantage a very high one, the limit being reached only when the drill bends and breaks. But with hammer drills this limit is reached much earlier owing to the breakage of bits, pistons, anvil blocks and shanks of the drill steel. The Chersen machine with piston having a diameter of 2¾ in. and a 6-in. stroke exceeded this limit for ⅞-in. steel even when the air pressure was only 50 lb. per sq.in., and bent drill steel and broken bits resulted.

TABLE I. RESULTS OF SOUTH AFRICAN MINES STOPE-DRILL CONTEST.

Name of Machine.	Type.	Size of Starter Bit. Inches.	Cubic Inches Rock Per 1 In. Drilled.	Rate of Boring Inches Per Minute.	Size of Finisher Bit. Inches.	Cubic Inches Rock Per 1 In. Drilled.	Rate of Boring Inches Per Minute.	Percentage Decrease of Rock Cut in Smaller Hole Compared with Larger.	Increase Per Cent. of Speed in Boring Smaller Hole as Compared with Larger.
Kimber	Hammer	1¼	2.76	1.13	1¼	1.22	2.01	55.8	77.8
Little Wonder	2-in. piston	1¼	2.40	0.80	1¼	0.99	1.30	58.7	62.5
Gordon	Hammer	1¼	1.76	1.61	1¼	0.99	1.89	43.7	16.7
Kid	2-in. piston	1¼	1.76	1.23	1¼	0.99	1.71	43.7	47.2
Ingersoll	2¼-in. piston	1¼	1.76	1.73	1¼	0.99	3.30	43.7	90.7
Flottman	Hammer	1¼	1.76	0.97	1¼	0.99	1.73	43.7	78.3
Holman	2-in. piston	1¼	2.40	1.45	1¼	0.99	2.29	58.7	58.0
Chersen	2¾-in. piston	1¼	1.76	1.60	1¼	0.99	3.63	43.7	127.0

EFFECT OF SIZE OF BIT ON DRILLING SPEED

Nothing is more striking than the great increase in drilling speed corresponding to a reduction in the diameter of the cutting edge. With piston of the same size while using the same air pressure, the speed of drilling bears a fairly definite ratio to the size of bit used, the area of hole excavated, and the amount of rock broken. This is shown by comparing the speed attained by competing machines on the water holes when boring with starters and with finishing bit. Table I accompanying this article shows a remarkable rate of increase in drilling speed corresponding to the reduction of the diameter of the hole drilled, and it will be seen that the most powerful machines benefit most. By looking at Tables I and II it will be seen that most of the value of the results of this test as published was lost for comparing the boring speeds of hammer and piston drills owing to a misunderstanding of some sort as to the sizes of bits to be used and the distance to be bored by each bit. Table II shows this clearly, when a comparison is made of the first six completed wet holes bored in this test. It will be seen at once that the Kimber hammer drill and the Little Wonder and the Holman piston drills, all having a piston diameter of 2 in. and a 5- and 6-in. stroke, respectively, were hopelessly handicapped from the start by the mistake made in selecting wrong sizes of bits, for the Kimber machine had to excavate 67 per cent. more ground than the Gordon drill. The Little Wonder drill, whose performance in the test disappointed its agents, had to excavate 17.6 cu.in. more rock to gain only 3.7 in. extra depth of hole, and the Little Holman drill had to excavate 24 cu.in. more for a hole only 3 in. longer. The Gordon hammer drill put in holes 40.7 in. deep with only 52 cu.in. excavated. Of this 40.7 in. only 6 in. was bored with the starter, 8.8 in. with the second, 10.5 in. with the third, and 15.35 in. with the 1⅛-in. finishing bit. In actual underground work the steel used would be somewhat bigger.

It will be seen that of the piston machines both the Chersen, 2¾-in. diameter and 6-in. stroke, and the Ingersoll Baby, 2¼-in. diameter and 5-in. stroke, as well as the Flottman hammer drill show a higher average rate of boring speed per minute of actual drilling time than the Gordon drill and that the Kid drill, 2-in. diameter and 5-in. stroke, drilled about as fast in spite of the fact that broken steel spoiled its performance. The Little Wonder and the Holman 2-in. drills also were not far behind. The result of this competition, however, tends to bear out the American experience that I quoted in another article of a different type of hammer drill compared with a 2¼-in. piston machine. Where the Gordon or other water-feed type of hammer drill shows superiority is, first, in the ease and rapidity of erection, and second, in its power to bore with equal speed in any direction.

TABLE II. RESULTS OF SOUTH AFRICAN MINES STOPE-DRILL CONTEST. WET HOLES.

Name of Drill.	Boring Rate on all Completed Wet Holes Average Inches Per Minute.		Average Depth Hole in Inches.	Amount of Cubic Inches Rock Excavated, Average Per Hole, no Allowance for Wear of Bits.	Percentage Depth Hole Bored with Bits 1¼-In. and Over.	Inches Depth Bored with 1¼-In. Bit and Over.	Percentage of Rock Excavated with 1¼-In. Bit.	Sizes of Bits Used in Inches.
	50 Lb. Per Sq.In.	60 Lb. Per Sq.In.						
Kimber	0.89	1.46	40.83	86.778	100	40.83	nil	1¼, 1½, 1¾, 1¼, 1½, 1¼
Little Wonder	1.25	1.43	44.39	63.606	78.2	34.69	13.7	1½, 1¼, 1¼, 1¼
Gordon	1.57	1.89	40.77	52.023	62.45	25.41	29.3	1¼, 1¾, 1¼, 1¼
Kid	1.21	1.89	41.52	57.636	73.65	30.59	20.5	1¼, 1¾, 1¼, 1¼
Ingersoll	2.08	2.57	42.60	57.325	69.10	29.44	22.6	1¼, 1¾, 1¼, 1¼
Flottman	1.70	1.90						
Chersen	2.35	2.94	42.96	58.275	58.275	32.83	17.6	1¼, 1¾, 1¼, 1¼
Holman	1.23	1.52	43.50	76.289	76.650	32.17	16.25	1¼, 1¾, 1¼, 1¼

I thought before the test that, owing to the use of an arm, bar and clamp being necessary, the difference in the ratios of actual boring time to total working time for hammer and piston drills would not be so marked on these fields as in America. On the surface in these trials, the highest average for a hammer drill was about 86 per cent. of the actual time and for the piston drill about 79 per cent. In narrow underground stopes the difference would be greater in actual practice, but chucks of piston drills have been so much improved lately that drills are changed almost as rapidly as with hammer drills.

*Brakpan, South Africa.

Comparative Merits of Hammer and Piston Drills

I must again, in the light of the results of this competition and other later evidence, review the comparative merits of hammer and piston drills for work in hard rock under the conditions existing on the Witwatersrand. Generally these trials are held to have shown that the hammer drill is a more efficient machine than the piston drill; in other words a larger percentage of the total kinetic energy of the blow is spent in the useful work of cutting rock. This may be true, but in a hammer drill quite a large percentage of the total kinetic energy of the blow is spent in heating the steel and in overcoming the elasticity and inertia of the drill steel and of the striking pin or anvil block. The longer the steel, the greater is this loss, though in a piston drill it is not noticed so much as it otherwise would be since on the longer drill steel the cutting edges are narrower and so have less work to do in excavating the hole. That this loss is serious is well shown in Table I.

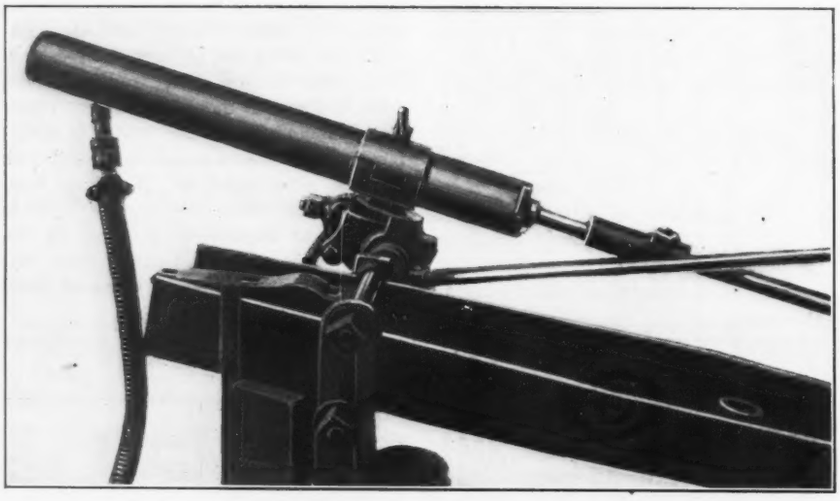
It will be noted that the increase of drilling speed of the Gordon drill with 1⅛-in. bits is not nearly as marked as with the piston drills owing to this loss being greater with long steel. This increase amounts to only 16.7 per cent. in the Gordon drill against 90.7 per cent. with the 2¼-in. Ingersoll. What the actual amount of these losses is with hammer and with piston drills is hard to determine experimentally. Gillette states that in driving piles 60 per cent. of the energy of the blow of the falling hammer is lost.

Losses of Power in Piston Drills

The losses of power are many in piston drills. There is friction in the machine itself, due to bad fit, poor lubrication, tappets, auxiliary valves and piston rings as well as slackness and leakage owing to wear. There is the friction of the drill-steel during its stroke on the sides of the hole which prevents rapid reciprocation and causes a portion of the force of the blow to be uselessly expended against the side of the hole. This wears away the wings of the drill bit and causes more loss by these vibrations' increasing the vibration of the mounting, that was originally caused by a variation between the axis of the drill bit and the true axis of the machine. This vibration causes a bit on starting a hole to strike every time in a different place, thus throwing bending stresses upon everything and causing more rock to be cut than is necessary. This tends to cause rifled holes and increases the losses in friction. The chief causes of friction losses are bad design and undue wear of the chuck, chuck bushings and guides. Speaking from experience in Australia and on the Rand these losses are appalling; machines are allowed to remain below month after month until, many times, a starter placed in the chuck and tightened up tends to describe a circle having a diameter ½ in. or more larger than that of the bit. This is no exaggeration. A rigid inspection of all chuck bushings should take place every fortnight, and a starter should be tested for its eccentricity in all machines when tightened up.

Another cause of rubbing against the sides of the hole is unequal length of the wings of the cutting edge. Machine sharpening and the introduction, if practicable, of detachable bits tend to remedy this. The accompanying illustrations, taken from a paper by Mr. Mills in the *Journal* of the Mechanical Association of the Witwatersrand, show these conditions well. There is also loss due to lack of rigidity of the striking tool in the shaft and shank, as shown by Mr. Anderson's experiments which will be referred to later. Loss of power is also due to pulverizing rock already broken from the bottom of the hole and to churning up mud or dry cuttings in a hole. Working too long with blunted tools is another cause of loss for it causes the rock to be crushed rather than to be chipped from the bottom of the hole. The amount of this loss has to be balanced against the time lost in changing steel more frequently, and the cost of providing and sharpening extra steel. The amount of these losses in a piston drill is great, and it is said that a piston drill indicating 5 h.p. in cylinder uses only 1½ h.p. in useful work cutting the rock.

Difficulties in using air expansively are not so great in hammer drills, as in piston drills, and indeed in many of the valveless drills expanding air causes the forward stroke, but it was not until recently that a piston machine had succeeded in combining the necessary drilling speed and power to reverse the stroke with the use of air expansively. That is another loss of power, as is the fact that the length of stroke in the piston drill is controlled by the operator.



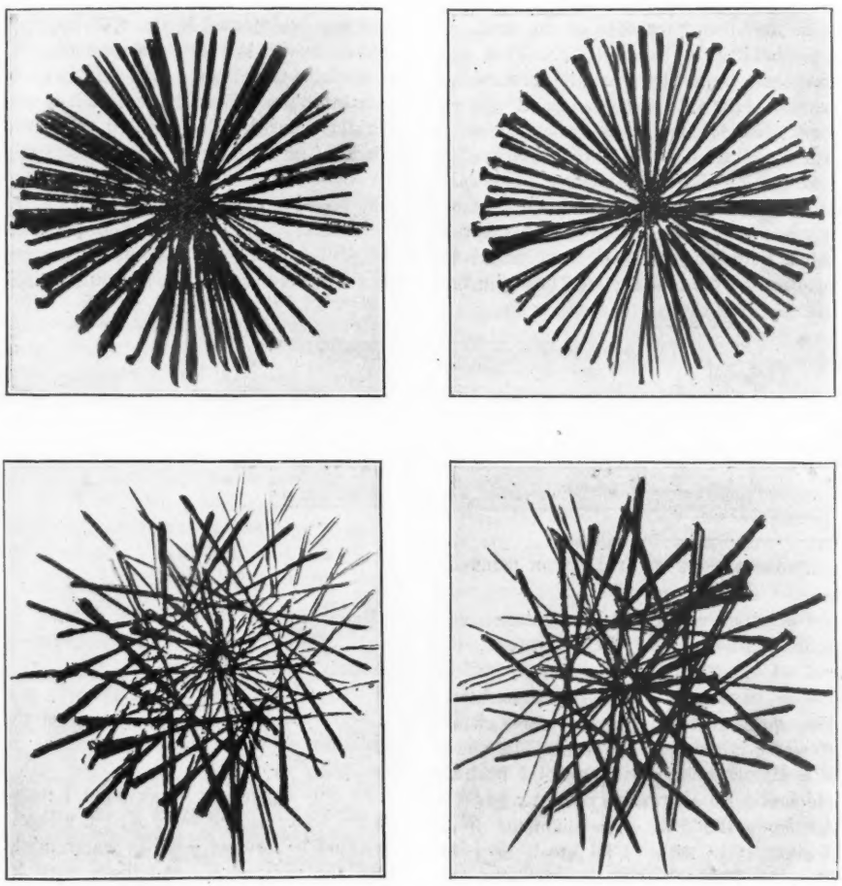
KONOMAX AUTOMATIC PISTON DRILL

Loss of Power in Hammer Drills

Now the hammer drill as exemplified in the best types has not so many possible sources of lost power. Besides the loss of power due to the fact that greater expansion of the air is not effected, more power is required to produce rotation in a hammer than a piston drill, as the bit is pressed against the bottom of drill hole all the time. In most hammer drills there is not much room for improvement in theoretical efficiency, for the rock cuttings are ejected either by air, or by air and water, as soon as detached so that the bit meets solid rock every blow. Drills can be changed oftener with less loss of time and thus during drilling the bits are on the average sharper. The bit is kept cool. Friction on the sides is reduced as the bit is not withdrawn at each blow struck. In addition, there appears to be a better chance of applying the more efficient and economical force of electricity in the hammer than in the piston type of drill; indeed, the Box drill has been devised on this principle. Various practical difficulties, however, have so far retarded the successful development of electric drills.

I have now reviewed the chief losses of power in piston and hammer drills, but before inquiring how the work of the piston drill can be improved I must refer to the hammer drill as a practical economic machine for use in hard ground. The hammer drill is evidently a success in certain mining districts in North America, but so far as I know, the large size has not been able to gain and keep a place in competition with piston machines in the hard-ore mines of Australia, Rhodesia and the Transvaal. Improved types are, of course, always coming out, and I do not wish for a moment to state that it cannot compete successfully. But I have with me

letters from mine superintendents in Victoria, Australia, and others in Rhodesia, and all tell a story of failure. In the 1903 trials held in Johannesburg, the Leyner drill failed to cut hard granite with the same relative air consumption as the best piston drills. When I last made inquiries it was in use in only two mines on the Transvaal and that in a small way. The trouble has been said to be that on the Rand the air pressures in use were not high enough for the attainment of maximum efficiency. Yet even with the low air pressure there has been much breakage of chucks and other parts, resulting in much lost time and increased cost of maintenance.



PHOTOGRAPHS OF BOTTOMS OF DRILL HOLES; 1, WINGS OF BIT OF UNEQUAL LENGTH; 2, DRILL STEEL, SLIGHTLY BENT; 3 AND 4, DRILL STEEL BADLY BENT

Nor has our experience with small hammer drills on the Rand to date been a satisfactory one. There is no field for its use "Cripple Creek style" with solid steel and vertical or nearly vertical up holes. Here it must have a water or an air-and-water feed. The Leyner small drill (Rock Terrier) came and has apparently gone again. The No. 3 Murphy drill with water feed a year ago was going to solve our problem, but I cannot find any number in use anywhere here; so with the Hardsocg Wonder and others. The Gordon drill was tried, condemned and then improved with parts made by perhaps the foremost engineering firm in its line in the world, and then brought back. It performed well in the recent trials, showing a good boring speed and was introduced to Rand rock and Rand mining conditions after the trials. The results so far have been disappointing so that at the present time the Gordon drill is used in very few, if any, mines on the Rand. As far as I can learn the troubles have arisen partly from drills' breaking and sticking in the holes and from unfinished holes, but mainly, however, from valve troubles, such as sticking, wearing and breaking of the valves, and from the breaking of striking pins, anvil blocks and even the pistons under the blows delivered with high velocity necessitated by the long stroke. Trouble regarding the supplying of water to the drill has not been wanting; not only because the mines could not always supply water free from grit and at just the right pressure, for excessive pressures cause leakage, but also because the water in the mine is acid and it always manages somehow to get into the machine with which it is used. The results of corrosion are most surprising even after a relatively short time. Then there was the added expense of hollow steel and of water pipes and water hose which are a nuisance in stopes, and of the water itself which, when many machines are used, becomes in time a considerable item. The drill appears as simple as it is possible to make it; but I believe strenuous efforts are being made to improve the drill and eliminate the weak points. Personally I think that it was a mistake to use a light piston hammer, weighing 1¼ lb., and working under a high velocity due to a long stroke (8 to 10 in.), which delivers its blow on a tappet or anvil block having a diameter of only 1 3/16 in. Indeed, one leading engineer on the Rand has figured that the force of this blow is more than any steel can bear. A shorter stroke and heavier hammer is, I believe, mechanically and theoretically a better arrangement, but the other arrangement had to be adopted to give the drill the shape and form it has.

Ways of Improving Piston Drills

Here on the Rand we are turning to our old friend the piston drill, and are asking where it can be improved and what can be done to increase its efficiency and reduce the losses mentioned. Friction in the machine itself can be reduced by improved design and by introducing some scheme for automatic or more continuous lubrication. This can be done. It is being tried in America by the Western Lubricating Valve Company, while here on the Rand one machine has an attachment which uses a semi-solid lubricant, and in the machine described later there is a special oil chamber. The Ingersoll ball-valve attachment makes lubrication when set up for running easier; but the kind of "miners" that are often intrusted with the running of machines on the Rand is shown by the remark: "I want an Ingersoll, as you can give it one dose of oil and it will run for the rest of the shift while the other must be oiled often," made by a former employee of the company for whom I am working when he refused to work with any other make of machine than an Ingersoll. This is no doubt a compliment to the Ingersoll, but the remark serves more to show the conditions under which too often rock drills have to work.

In machine drilling loss by vibration of the mounting must always exist, but it can, I think, be reduced by shortening the stroke and by increasing the number of blows per minute, and also by increasing the rigidity of the boring tool. This last can be effected by increasing the diameter of shanks employed by making all shanks up to 1¼-in. diameter; by doing this, it is said that a gain in boring amounting to 20 per cent., as compared with ordinary steel, can be attained. Using a very solid turned-steel shank and shaft and a mathematically true detachable bit of his own invention, Mr. Anderson obtained results better than this. He claims to have increased the boring speed at the property of the May Consolidated Gold Mining Company from 6 holes to 12

holes per day, and, Mr. Cameron, an American engineer, has, I believe, given an order to equip the whole mine with this device. Whether it will in practice prove suitable and manage to avoid the fate of other detachable bits does not concern us at present.

The chief loss of efficiency on the Rand is in boring up holes at a flat angle in drives. Owing to the accumulation of broken particles in the hole the bits have to do the work twice over. The advertising columns of the JOURNAL show that an attempt on very sound lines has been made to increase the efficiency in this respect by means of lugs on solid steel. Hollow steel, as used in the Climax Little Wonder drill, with live air passing down it also bores such holes more rapidly, and again attempts are being made to pass water or water mixed with air down hollow steel in piston drills. The fact that the United States of America Patent Office has granted patents for such devices goes to show that there are no legal difficulties in the way. The Konomax drill, described in my paper in the JOURNAL, May 23, 1908, p. 1045, shows that it is possible to reduce the air consumption of piston drills at least 20 per cent., thus bringing them on a level with the claims made in regard to large hammer drills. The use of higher air pressures will also, on this field, enable a smaller machine to do the work at present done by larger sizes, and if any assistance can be given to the ejection of broken rock particles, the machine can be lightened by working on a shorter stroke.

THE KONOMAX AUTOMATIC, PISTON DRILL

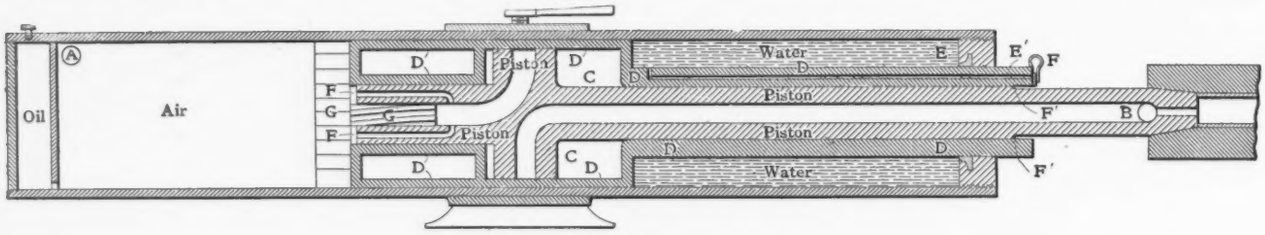
The inventor of the Konomax drill has been working along these lines in endeavoring to design a successful light drill for stoping on these fields. An accompanying illustration shows the general appearance of this drill. The sectional drawing is intended only to show the general idea and is not correct as to detail. It will be noted that the general appearance is similar to that of the Gordon hammer drill; it weighs about 85 lb. The machine is a piston drill, having a 2-in. piston and uses a short stroke, only 4 in. long. It will be noted that the inventor has evidently adopted views similar to those laid down in a former article of mine. This drill works on the Konomax principle, for air at constant pressure acts on the back of the piston producing the forward stroke, while the back stroke is produced by air acting on a portion of the piston of double the area, the air being cut off at half stroke and then used expansively, thus reducing the air consumption.

A former type of this machine had a valve working in the piston and an exhaust along a hollow tail rod at the rear. This was subject to some disadvantages. Exhaust now takes place through the hollow piston rod to the chuck, and, if required, along hollow steel. The exhaust ports in this machine are longer than in the large drill, and there would be danger of their "freezing up," were it not that the jar of the blow detaches any ice and keeps the ports open. It will be seen that the outer case of the drill is a pipe held in a band clamp. This drill case can be easily moved forward or backward in this clamp so as to get the right distance from the rock face or to use a drill for a longer period than the forward feed of 12 in. allows. This pipe has an oil nut leading to an oil chamber at the back end. This oil chamber is fitted with an automatic appliance for feeding the oil. At the side near the rear end is a two-way cock for admission and exhaust of air. At the front end, the end of the cylinder proper projects, as shown in an accompanying illustration. The spring valve regulating the exhaust of water is also plainly seen. The chuck is a simple one, having a solid bushing and bolt with an ordinary key or pad for tightening the drill. The diameter of all shanks, even with ⅞-in. steel, is 1 in. This, as before stated, has a most important effect.

The cylinder itself, which is made of phosphor bronze, is of the shape shown, but no packing rings are shown. Water is admitted at the front of the cylinder under slight pressure until the cylinder is driven right into its cover, as shown in an accompanying illustration. Then the admission cock for water is turned off. When air is turned on the water under pressure tries to pass along passage *E'* and escape past the spring valve at *F*. This spring device is not final, and probably a small piston under air pressure will be found better than the spring.

This machine is valveless, but probably works, as is shown, by an arrangement of holes in the piston and some grooves or ports in the cylinder walls. On the piston is a circular projection *F'*, which, when the designed stroke is exceeded, engages the end of the valve *F* and allows water to escape feeding the cylinder forward as the drill cuts the rock. The drill is thus automatic in its forward feed and one man could change steels in two machines easily. Unless all the water is out the machine cannot possibly hammer the front head.

While I was watching this machine at work it bored suddenly through the block, and the water buffer gave ample time to turn off the air before any damage was done. Part of the exhaust passes up the hollow steel; there is also an arrangement, which is not shown, whereby water can be mixed with the air if desired, or water alone can be injected in the type having a rear exhaust. While I was watching it, the machine bored more than 3 ft. in granite in less than half an hour, and it is said that this machine has drilled 18 in. in this hard granite in six minutes, using only one drill steel. It is reckoned that eight holes, 3 to 4 ft. deep, can be bored in one shift in Rand banket and quartzite. The drill appears most simple on account of its valveless action. This is much easier arranged in this type of drill than in others, since admission and exhaust of air occur on one side only of the piston, and only once a stroke; consequently piston and cylinder wear will not affect the regulation of the action as much as in some other designs.



KONOMAX AUTOMATIC PISTON DRILL

The only apparently weak point I noted was the water-escape valve *F*; but a better one could be devised. Gritty water might choke the passage *E'*, and there must be a supply of water from mains or a pressure tank to work the drill. The drill should be cheaply made as it has very few parts, and I think deserves the remarks I made in my paper that it is most ingenious and simple. One of the defects of the Gordon drill was that it was too foolproof, and it was impossible to effect even simple repairs to it without the aid of a fitter and his tools.

In this machine the ratchet box is certainly inaccessible, but well designed rotation devices now give little trouble; all the holes I inspected were of good shape, showing no signs of rifling. What the results will be when the machine is used in actual work underground remains to be seen, but the machine surely looks promising.

A New Plan of University Development

Details of Scheme for Amelioration of Social Conditions at Columbia Submitted to the Applied Science Alumni and Graduates in Architecture

BY JAMES F. KEMP*

The alumni of the School of Mines of Columbia University and of the allied Schools of Engineering and Architecture held a joint dinner at the Hotel Astor, Feb. 17. Between 200 and 300 graduates were present, and addresses were made by Professors Van Amringe, Chandler, Munroe, Hutton, Hamlin and Kemp, and by Dean Goetze, and John B. Pine, of the board of trustees. The contribution of Professor Kemp touches upon some hitherto neglected phases of the university problem and as it may involve points not without interest to the many graduates of our other technical schools and universities, the paper is placed before the readers of the JOURNAL.

A PLAN FOR IMPROVING CONDITIONS IN COLUMBIA UNIVERSITY

For a long time past I have been impressed with some anomalous features in the social life of Columbia University, and after serious meditation upon the subject, I have concluded to maintain silence no longer, but to submit to the Applied Science alumni and especially to the graduates in architecture a plan for improvement. We are very much in the position of the shoemaker's children who go unshod—or, expressed in another way, we are confronted with abundant charity and yet none of it beginning at home—or in still different form, we have a dozen or so of preachers and no one of them practicing his doctrines in his own parish. Thus, year after year our professor of sociology discusses the amelioration of conditions downtown, or in the crowded quarters of London or in Mostar, Herzegovina, but whoever heard him refer to the Columbia faculty and its present disadvantages.

We have, again, several professors of economics and political science, all of whom and with some repetition among themselves discuss at great length tariff and free trade in China, Thibet and German New Guinea, but who never utter a syllable about the principle of protection as applied to their fellow members in the teaching staff. Therefore, as we all know the severity of conditions involving food, lodging, clubs and amusements in this city, I have addressed myself to the problem, and I now have the honor to present to this august and influential body the aforesaid plan for betterment.

In order to improve the conditions of living I have passed in review all sorts of schemes. We might consider, for example, transplanting the teaching staff in a body to the hights of the palisades in New Jersey, just across the river, and starting a colony in the woods of the neighboring State. One or two of our courageous pioneers have already gone thither and the movement might appeal to our manliness in that it resembles the work of forefathers who cleared the wilderness. But it has the disadvantage of taking some people to the frontier who are not accustomed to its methods of life. What success, for instance, could my colleague the professor of dramatic literature expect to have, if he were forced to wield a real ax instead of a figurative one? And how could our grubbers after Greek and Latin roots make headway with those of an oak tree? Worst of all, how could we still maintain existence, even though our physical health were greatly improved if we were cut off from the life of the metropolis by the waters of the Hudson and nobody knows how many feet of silt and gravel on its bottom? When we turn to the hills of Westchester the same objections arise, or if we look toward Brooklyn —but of course Brooklyn would not answer.

Therefore Manhattan island alone remains, and on Manhattan the only available site is the southwest corner of the university grounds. Therefore, secondly, I propose the erection upon this site of a 45-story apartment house to be called the Cosmos. With the actual details of size I will not trouble you beyond saying that it should be 150 ft. (46.15 m.) square, and should have a well or hollow space in the center 50 ft. (15.3 m.) square, leaving thus a hollow rectangle 50 ft. (15.3) wide all around. The ceilings should be 10 ft. (3.07 m.) from the floors, and this hight with a 1-ft. (0.3 m.) thickness of floors would call for a building only 500 ft. (153.8 m.) high, a very moderate altitude as buildings now go in this city. There is an excellent rock foundation, a magnificent view, nearness to the university, subway, trolley cars, Pabst's in Harlem—in fact all the advantages one could desire. Into the Cosmos I propose that all the teaching staff of the university and the librarian and president be gathered as a part of the terms of their appointments, and that they be provided with quarters rent free, but in accordance with the following general scheme. In the scheme the reward of good service is constantly held out in the form of advancement in the social scale. This advancement, always upward, takes place with one or two exceptions in a regular and systematic way, and is suitably recognized and recorded in official titles.

At the bottom we should naturally begin with the assistants and the necessary space in the form of individual suites of two rooms each should be assigned to them. The senior assistants should have, of course, the outside rooms, and especially those in front. The newly appointed should have the darker rooms opening into the central well. This has the great advantage of making the home surroundings of these young men not too attractive. It is very bad policy to constantly tempt away from their duties those whom the weight and experience of years have not yet steadied into habits of industry. At present I have often observed that the fine views from the windows of the two dormitories, Hartley and Livingston, lead these young persons to spend too much of the day dreamily puffing a pipe and gazing off into space, without I have felt confident, having their minds fixed on eternal verities of science or mathematics, but presumably on the eternal feminine. If a young and impressionable instructor could look only into a well 500 ft. (153.8 m.) deep he would remain by preference at his desk in the laboratory or museum where anxious seekers after knowledge or fossils or minerals could find him.

OFFICIAL TITLES

The official titles of these young persons should also correspond. Thus we would have duly recorded in the catalog used in our official relations: First-Floor-Back-Entry-Assistant Rogers, Second-Floor-Front-Entry-Assistant Kirk, etc. As we rise in the scale to the tutor's and instructor's grade, on the next floors it would be necessary to have larger suites, in fact, those of sufficient extent to give each man at least one outside window. Instructors in particular should be provided with suitably commodious and extensive quarters. In official life titles similar to those just mentioned would, of course, be employed. Thus, Third-Story-One-Front-Window-Tutor Morrison; Third-Story-Two-Front-Windows-Tutor Doctor Jouet; Fourth-Story-Two-Back-Windows-Instructor Judd; Fifth-Story-Front-Bay-Window-Instructor Berkey, etc. You all see how it would naturally develop—just like the Mandarin of the yellow button, Cheng Fong Wing, or the Mandarin of the three green buttons and the yellow jacket, Ting Tang Tong. We have abundant familiar precedents.

*Professor of geology, Columbia University.

Next above would come the adjunct-professors with properly expanding accommodations. If you should hear, for example, Eighth-Floor-Front - Adjunct-Professor Campbell, you would know at once that said incumbent was in his second year as adjunct-professor and had reached the front apartments. Tenth-Floor - Front - Adjunct - Professor Mayer would imply quite long service.

Next above would come the professors again with expanding quarters and, of course, with fewer to the floor. Thus if we heard the title Sixteenth-Floor Five-Back - Windows - and - Portico - Professor Walker, we would know that Professor Walker was new at the business, but that he had one of the finest suites assignable under the rules. Twenty-Fifth-Floor-Southern-Exposure-Professor Peele would imply a moderate number of years, but of distinguished service. And so on to the top of the professors' stories.

Now all of these apartments thus far mentioned being assigned by seniority, it would be necessary when anybody was promoted, or died or resigned, to all move up one, two, or five places as the case might be. Within the grades care would be exercised to have the apartments sufficiently similar in size and arrangements to facilitate the removal of furniture, since, of course, with promotion from a lower grade to a higher every man naturally expands. Statistics show that an assistant has, as a rule, two ordinary chairs, a morris chair, three sectional bookcases, three framed photographs, and an iron bed. A tutor adds a rocking chair, two ordinary chairs and three sectional bookcases, but usually the framed photographs by some strange process are now reduced to one, and almost always the occupant of the frame is a girl. An instructor adds various articles of furniture often including a high chair; an adjunct-professor still more, while a professor has a notable quantity especially of bookcases, which he seldom, if ever, opens. By a little ingenuity a scheme could be readily devised whereby the rooms could be divided off into imaginary squares like a map in an atlas, so that a tag on a chair reading *G* 12, would enable the skilled force of janitors to put the chair away at once.

Advantages of the System

There is one additional great advantage in this progressive system of titles which makes them infinitely superior to the one now prevailing. We have, as you know, the Lieber professor of history, the Jay professor of Greek, and others of similar character. Now when in the faculty meetings the president calls upon the lieber professor of history, it is objectionable for two reasons. In order to have his German correct the president ought to say, "the lieber herr professor," and not so doing he sets a bad example to those professors who, not being well trained in German, might make the mistake outside. In the second place it draws objectionable comparisons. Why should one individual be the president's or university's one lieber professor and all the other be grouped in a bunch not dear to him or it? How much better to say, "The Thirty-ninth-Story-Front-Professor of History."

Again, imagine the distressing experience of our colleague who is addressed month after month and in the most public way, as the jay professor. How much better to say, the Fortieth-Story Front-Corner Professor of Greek.

There are thus many minor arguments in favor of the plan and others would doubtless occur to one on reflection. But you will say no mention has been made of the deans of the several faculties. That is true, and at the outset I was much puzzled myself. If they were placed on the floors above the professors what could we do with them when they resigned and now that so many terms of office are so short, how could we provide for them in a plan that is fundamentally progressive? How provide, moreover, for our numerous acting deans? But all these difficulties have recently been dissipated because, as we all know, the deans, like the snakes in Ireland, have begun to swallow each other, and in a year or two there will not be any at all.

The Theodore Roosevelt professors on their return ought, however, to have the 41st floor, and with them should be quartered the Kaiser Wilhelm professor in a fine and suitable suite, the best the university could provide. Somewhere in this region should be the librarian. I have hardly known where to classify him; but then, for that matter, neither did the president and trustees for quite a good many years. Next above should naturally be placed the president with the entire front of the house and so much of the sides as might be necessary. In the rear might be placed the secretary of the university.

The Crowning Feature

There remain still two or three stories, and these are, of course, to be reserved for those venerable men of emeritus grade who have retired on the Carnegie foundation. At present they are forced to seek the fresh air, fine views and reduced rents of the country. But in the upper stories of the Cosmos they would have all the fresh air and the views without any rent whatever. It is but proper to recognize long service by assigning to these officers the most desirable quarters in the entire structure. Besides this arrangement leads naturally to the final feature in the plan; I am led to suggest this feature by three important considerations: (1) From deep interest in the work of my colleagues in archeology, Egbert, Wheeler and Gottheil, I desire to see their successors a few milleniums hence provided with good and significant records for the study and reproduction of these times. The records should take the forms with which archæologists are generally familiar and which they understand. (2) I have often been impressed as I have walked round and round this campus with the anomalous condition that now prevails, in that we have a long row of cinerary urns and not a sinner in them. (3) All the philanthropists and benefactors of today have been so exclusively wrapped up in aiding people to live that they have overlooked the extremely serious situation which arises when a man in New York is confronted with the bills for his funeral and interment. Cemetaries are fearfully expensive things, and there is no Carnegie foundation on which we may fall back. Therefore I propose that every person on accepting an appointment in Columbia University should express his or her approval of cremation. A crematory should then be constructed on the roof of the Cosmos building to which all should naturally come. The department of metallurgy should be requested to compound an absolutely resistant and indestructible alloy, such as phospho-molybdenum bronze or several others which will occur to some of you. From these, suitable cylinders can be prepared with caps that screw tightly on. Upon the outside is to be engraved a sketch of the life and services of him whose ashes repose within. The inscription should be so expressed as to throw light on the history of the times.

I propose to recompense the department of metallurgy for their invention by turning over to them all the gold and platinum which would be caught in the crematory furnace from the fillings of teeth, etc. The cylinders are then to be stored away as follows: Presidential ashes in the bowls of the fountains in front of the university; Theodore Roosevelt professors and librarians in the urns on One Hundred and Sixteenth street; professors and adjunct professors in the urns on Amsterdam avenue and Broadway; instructors in the urns on One Hundred and Twentieth street. Holes are to be drilled in the granite and the cylinders, which would be naturally about a foot long by an inch in diameter, will be hermetically sealed therein by some indestructible cement. The funeral services will be simple. For presidential funerals all the staff would be ordered out. For others only their colleagues in rank. They would march in gowns and with hoods either inside out, or upside down, like reversed muskets, and the chaplain would perform a service like laying a corner stone on a small scale.

But some one remarks what about the ashes of the tutors and assistants? Well that does not seem to me a very serious question, but I would suggest that they be strewn on the grass of the campus, so that after decease everybody could continue to walk all over them, just as has always been the case in life.

The Coal Mining Industry in Bengal

The Indian Miner Is Paid 12c. per Day and Can Save 4c. from this Income. With Help of His Wife and Family, He Mines 96 Tons per Year

BY GLEN GEORGE*

Coal occurs in India over a widespread area, ranging from the hill coalfields of Assam in the north to that of Hyderabad in the south. The coal measure formations are exposed over a large part of this area. There are some 37 fields having an estimated approximate area of 30,000 square miles. But of these, only 8 are worked to any extent, while of the total output of India 85 per cent. is raised from the three coalfields in Bengal, those of Raneegunge, Jherria and Giridih. In view of the importance of these three Bengal fields compared with other districts, the following remarks will refer primarily to them.

Regarding the geological horizons on which coal occurs in India, the adopted classification of Indian strata differs from that of Europe and America, so that any correlation must be approximate. The following is taken from a paper of T. H. Holland, Director of Geological Survey of India:

Indian Strata.		European and American Equivalents.
Gondwana System	Jubbulpore series	Jurassic
	Rajmehal series	
	Panchet series	Triassic
	Damuda series	
	Talchir boulder bed.	Permian

The great coal-bearing strata is the Damuda series, called from the river Damuda, in whose valley the coalfields of Bengal lie. The total thickness in these fields is 8400 ft. The Damuda series in Bengal is subdivided as follows:

Upper or Raniganj (coal bearing, 5000 ft. in Raniganj field.
Ironstone shales (no coal seams) 1400 ft.
Lower or Barakur (coal bearing) 2000 ft. in Raneeganj.
3800 ft. in Jherria.

*Deputy chief mining engineer, Raneegunge, Bengal, India.

History and Growth

Coal was worked in Bengal in the Raneegunge field as far back as 1777, while by 1830 several small collieries had been opened out. In 1843 the Bengal Coal Company was formed, which, from a small beginning has risen to an output of 800,000 tons a year and holds a large area of coal lands. In 1868 a railway line was carried to the Giridih field, which was then opened up chiefly by the East Indian railway, which company now produces about 750,000 tons per annum. The third field, that of Jherria, is of more recent development and the growth of its output has been a remarkable feature in recent years.

The situation of these Bengal coalfields near Calcutta and the cost and the better quality of the coal have been factors which have caused their rapid development in the last decade. In 1898 their total output was:

		Tons.
	Raneegunge	2,216,000
	Giridih	653,000
	Jherria	750,000
	Total	3,619,000
In 1907,	Raneegunge	3,980,035
	Giridih	750,374
	Jherria	5,179,185
	Total	9,909,594

Development is still in progress and the output must farther increase.

General Characteristics of Indian Coals

The seams are thick on the whole, the majority of the seams worked being 12 to 18 ft. In a few cases beds 30 ft. thick are being developed, while in limited areas, seams 60 to 90 ft. thick exist, owing to the amalgamation of several beds. The seams are almost always inclined, but not at steep angles, the dip being, as a rule, 1 in 10 to 1 in 5. Faults are not so frequent as to be vexatious. Igneous dikes, on the other hand, give a great deal of trouble and a considerable area of one of the best seams has been spoiled by them. They are of two types, dolerites, and mica-peridotites. They vary in thickness from 3 to 100 ft. or more, burning the coal on either side. Mica-peridotites have a tendency to flow along under the seam and consequently are more destructive.

As regards quality, the best Bengal coals are good. The defect of Indian coal is the rather high percentage of ash. On the other hand, the percentage of sulphur is low. The seams with the best reputations are the Sanctoria, Desherghur and Seebpore, of the Raneegunge field, Giridih coal and Nos. 14 and 17, of Jherria. Then follow a considerable number of seams slightly inferior, but still of fairly good quality. Following are some typical analyses, the figures representing percentage content:

(a) Desherghur Seam.

(1) Proximate analysis:

Fixed carbon	54.33
Volatile carbon	33.77
Ash	9.47
Moisture	2.43

(2) Ultimate analysis:

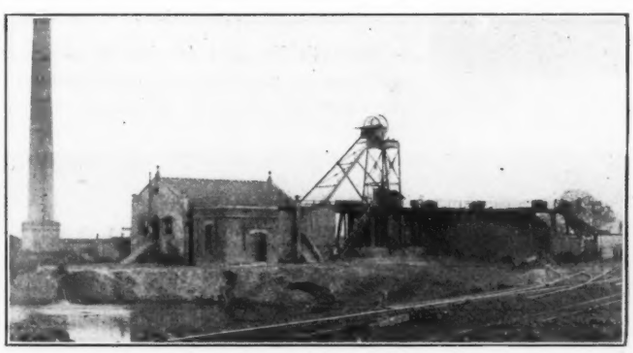
Carbon	69.19
Hydrogen	5.10
Oxygen	11.83
Nitrogen	1.59
Sulphur	0.37
Moisture	2.43
Ash	9.47

Calorific value, 6580 B.t.u.
Evaporating capacity, 8.18 lb. water per lb. of coal.
Specific gravity, 1.321.

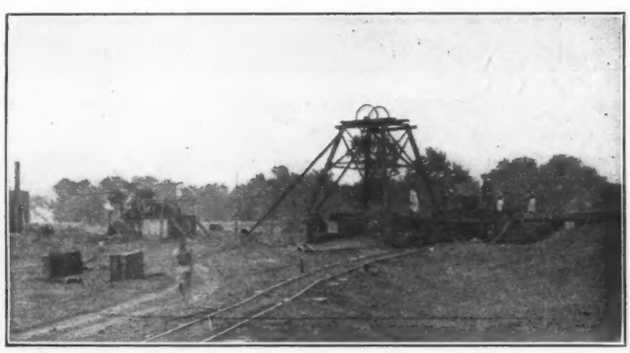
(b) Sanctoria Seam.

(1) Proximate analysis:

Fixed carbon	55.15
Volatile carbon	32.76
Ash	9.65
Moisture	2.44



SURFACE PLANT AT BENGAL COAL COMPANY'S NO. 5 MINE

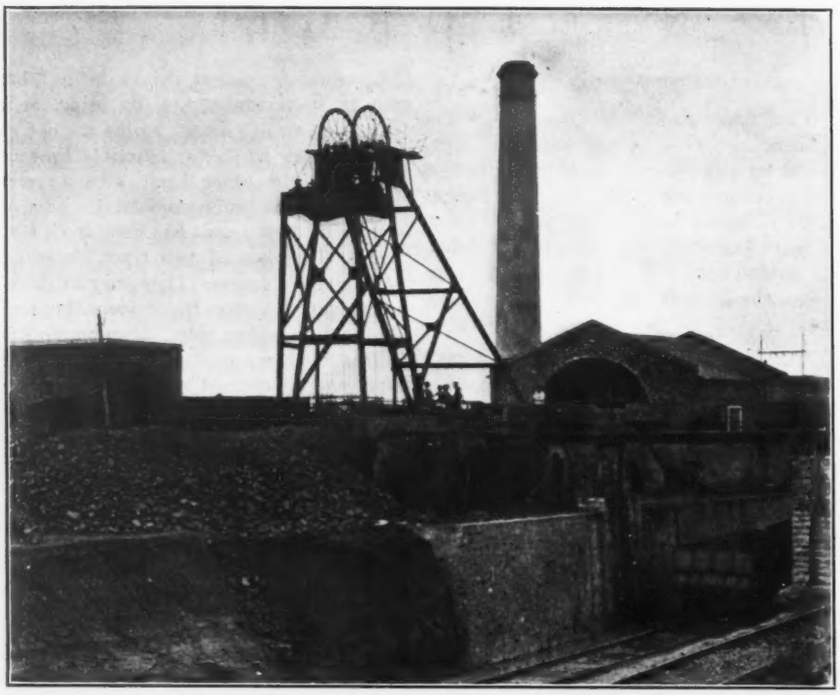


A NATIVE OWNED AND MANAGED MINE IN BENGAL

(2) Ultimate analysis:

Carbon	71.93
Hydrogen	5.00
Oxygen	8.76
Nitrogen	1.82
Sulphur	0.40
Moisture	2.44
Ash	9.65

Calorific value, 6884 B.t.u.



THE BENGAL COAL COMPANY'S NO. 7 MINE SURFACE PLANT

Evaporating capacity, 8.55 lb. water per lb. of coal.
Specific gravity, 1.366.

(c) SEEBPORE SEAM.

(1) Proximate analysis:

Fixed carbon	56.73
Volatile carbon	29.65
Ash	8.69
Moisture	5.02

(2) Ultimate analysis:

Carbon	70.67
Hydrogen	5.02
Oxygen	8.48
Nitrogen	1.62
Sulphur	0.55
Moisture	5.02
Ash	8.69

Calorific value, 6781 B.t.u.
Evaporating capacity, 8.43 lb. water per lb. of coal.

The above are probably the best seams in the Bengal coalfield. An average analysis of the second-class coals in the eastern half of the Raneegunge field, is about as follows:

Fixed carbon	46.70
Volatile carbon	31.65
Ash	16.60
Moisture	5.05

A considerable number of seams coke well, but the percentage of ash in the coke is high. The method of coke manufacture is crude and wasteful—burning in open kilns—and yields only some 40 tons of coke per 100 tons of coal. A range of by-product ovens is being erected by the East Indian railway at its Giridih collieries. Although a great deal could be done to improve the sale and price of second-class coals by picking, so far no systematic system of cleaning has been adopted.

DESCRIPTION OF COALFIELDS

The Raneegunge coalfield lies 130 miles northwest of Calcutta, and the exposed area is approximately 500 square miles. On the east, the coal measures dip under newer rocks and their exact extent is unproved. That they soon reach unworkable depths has been shown by a recent deep bore hole some 10 miles east of the coalfield. On the south, west and north the coal measures abut against metamorphic rocks. In shape the field is an irregular rectangle—the large diameter lying east and west—40 miles long by 5 to 17 miles in width. The coal deteriorates in quality in the extreme east.

The Raneegunge coalfield is nearer to Calcutta and the seaboard than those of Jherria and Giridih by some 40 miles and being well served by railways, has a slight advantage in the matter of freight. The Upper or Raneegunge measures are well developed (5000 ft. in thickness) and contain the best seams, the Deshergur, Sanctoria and Seebpore, besides a number of seams not quite as good in quality. The Barakur series also contain a few seams of fairly good quality. The Ironstone shales yield a fair amount of iron ore.

While the exhaustion of the Raneegunge field is far off, yet outcrop coal specially in the better seams has gone a long way to that stage. Future workings must be deeper, which will necessitate working larger areas from a single shaft or pair of shafts, and the employment of better machinery. All of this will tend to increase the capital expenditure and working costs.

GIRIDIH OR KURHURBARI COALFIELD

The Giridih field is situated some 70 miles or so northwest of Raneegunge on the Barakur river, a tributary of the Damuda. It is 11 square miles in area, only 7 of which are productive coal measures. In spite of its small area, this field had an output of 830,000 tons in 1905. Of this production, 700,000 tons came from the collieries of the East Indian Railway Company.

WORKING ON THE OUTCROP OF AN 18-FT. SEAM, REMOVING THE OVERBURDEN

The main seam is 18 ft., while there are several other beds less in thickness. The quality of the coal is good and it ranks among the best Indian coals.

Jherria Coalfield

The Jherria field, although the youngest of the Bengal districts, is now the first as regards output. It is situated on the Damuda river, some 40 miles west of Raneegunge. It is an irregular rectangle, about 17 miles east and west, 7 to 9 miles north and south, and is 200 square miles in area. The Lower or Barakur division is here greatly developed, being 3800 ft. in thickness and containing 18 seams. This field being comparatively new, only the shallow coal is at present worked, and costs are low. The quality of the fuel is good as Indian coals go.

The Upper or Raniganj series is not so well developed and contains four or five seams, none thicker than 8 ft., one of which—the lower—is considered first-class coal. The Jherria coalfield is well served by railways and a new Chord line, lately opened, has given it a greatly improved access to the up-country districts.

Methods of Working

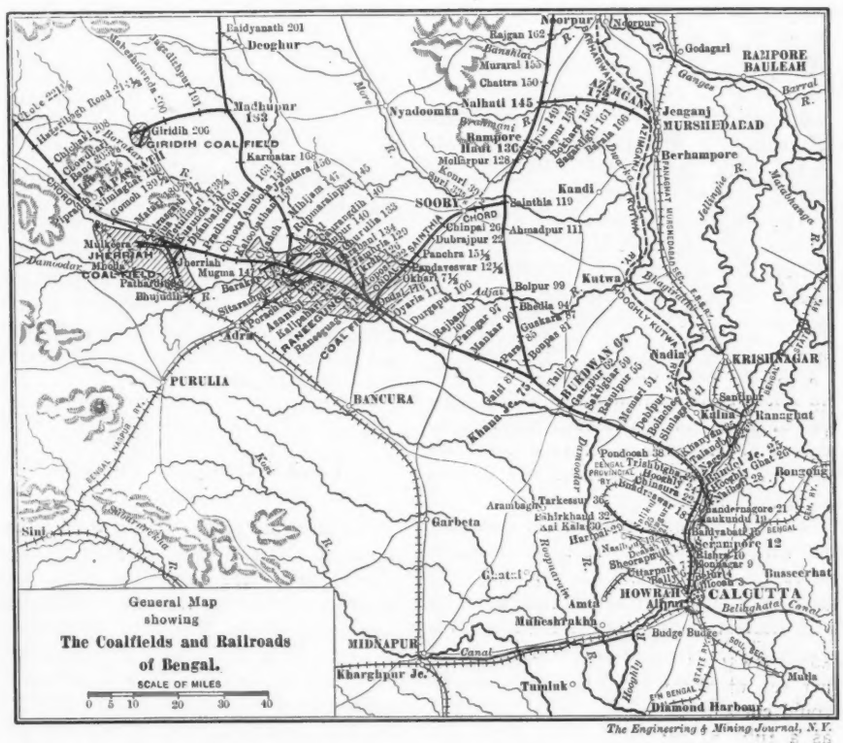
The usual method of working is simple. The poor quality of available labor, the high cost of timber, the thickness of the seams render longwall out of the question, or even any method of taking out a very large proportion of the coal is difficult. The almost unvarying method consists in driving two sets of galleries at right angles, splitting up the coal into square pillars. The usual width of the galleries is 12 to 16 ft., while the size of the pillars varies from 30 to 70 ft. square, according to the depth. Roofs are good and timbering is the exception. On reaching a boundary, or in any favorably situated area, the pillars are split and worked as much as possible before the area collapses. The average percentage of extraction is about 60 to 70 per cent. of the seam.

During this operation, spontaneous combustion is apt to occur, and in several cases considerable areas have been lost by fire. In the Giridih coalfield the exceptionally good roof has led to a more scientific method:

When the pillar, say 40 ft. square, is to be worked, the lower 5 ft. of the 20-ft. seam is worked with the exception of four blocks or "chowkidars," each 6 ft. square, one at each corner of the pillar. Any timber is then withdrawn and the four "chowkidars" are blasted out, causing the upper 15 ft. over the whole pillar to come down, and bringing 1000 tons of coal on the ground. Where this method is used, the wastage of coal is as low as 2 per cent. So far workings are of a moderate depth only, a 400-ft. shaft being considered deep. However, some 800-ft. shafts are at present being sunk and the exhaustion of shallow coal will soon lead to deeper workings and to some rearrangement of the system of working.

The occurrence of firedamp is rare, and safety lamps are the exception. The large size of the galleries and the number open, make the drag of the air currents small and in almost all cases natural ventilation, or turning the exhaust steam from pumps into a shaft, is found sufficient. In eight cases only have fans been erected, but soon deep workings must lead to a large increase in their number. Water is usually met with in fair, but not great quantities. In brief, it may be stated that coal mining in Bengal, so far, has presented no great difficulties from the engineering point of view.

The death rate of persons employed is low—0.76 per thousand miners above and below ground, as compared with the American 1.69, and the English 1.24.



The Engineering & Mining Journal, N.Y.

From the point of output, the death rate is high—7.47 per million tons, as compared with the 2.85 of America and 4.4 of the United Kingdom. Methods in the past have not been economical, large areas of pillars having been abandoned, owing to unskilful working. A great improvement has taken place in recent years.

Machinery and Equipment

Concerning mine equipment, India presents the most startling contrasts. Alongside a fairly modern colliery owned by a European company, will be found a native-owned concern, winding its coal in bowks by means of a woman gin. In the European companies the equipment is fair. As the depths are moderate and quick winding unnecessary, geared winding engines are the rule. There is a considerable number of direct-acting engines. Steel headframes are preferred to wood, good timber being expensive. Tipplers and screens are comparatively rare, hand loading into wagons (the coal is carried in baskets by women) being the usual method. Some of the large companies, however, are using tipplers, and an elaborate sizing and screening plant is being erected at one of the East Indian railway's Giridih collieries.

The factor of safety in winding and haulage ropes is high owing to the poor class of men (natives) looking after them. Underground haulage is not common, while horse haulage is almost unknown—the miners pushing their tubs long distances. Outputs of collieries are small in comparison with their individual area. A production of 200 tons a day per shaft would be a fair output. When the exhaustion of shallow coal necessitates deep shafts, larger outputs per shaft must be obtained.

The solution will probably lie in the adoption of coal-cutting machinery. Such a machine for India must be simple, strong, and as light as possible. A longwall machine is probably out of the question. The successful machine will undoubtedly be of the drill or puncher type. In two cases (at the Bengal Coal Company's Sanctoria colliery and at the East Indian railway's Giridih colliery) electricity is used for pumping, while a 500-kw. plant has just been erected by the Bengal Coal Company at its Sodepur collieries for pumping and haulage purposes.

In view of the large number of new collieries being opened, there is a large field for manufacturers of mining machinery, pumps, hauling engines and gen-

eral mining equipment. All machinery must be simple as the class of labor employed is poor, and engines must be designed to bear ill usage. A company has just been formed to supply electrical power from central stations and a large amount of electrical machinery will be required in the future.

LABOR

While Indian coal mining presents no great engineering difficulties as yet, the problem of securing intelligent labor is most perplexing. Labor is obtained locally and consists chiefly of the two low castes—the Bowries and Santhals—who are an aboriginal race. The Indian native is an agriculturist and has an almost passionate attachment to the land, and regards coal mining only as a disagreeable necessity, in spite of the fact that he can earn four to six times as much at the latter as at the former. This has led to the absence of the formation of any craft skill and the Indian miner is as bad a workman today as he was 40 years ago. He cuts only 96 tons per year, as compared with 572 of the American, and the 279 of the English miner.

The ordinary laws of wages and supply of labor do not affect him, as the idea of saving and accumulating money is altogether beyond him. He and his family can live on 3 or 4 annas a day (6 to 8c.), and as long as he has a little over for "grog" he has no thought for the morrow. In spite of the large increase in the number of mines, there has been but little increase in the amount of labor available and the competition between the various companies is keen.

The Indian miner takes down with him, his wife and family. He hews or rather beats out the coal and his wife and children carry it in baskets on their heads to the nearest tram line and tubs—often 500 ft. away. He gets paid 6 annas (12c.) per car of about 13 cwt., and while he could cut 4 to 6 cars per day, he refuses, as a rule, to cut more than one. He works on an average, 3 or 4 days a week. The present Indian mines, without any further development, if assured of a full and regular supply of labor, would probably be able to increase their output 50 per cent.

Working costs are fairly low, ranging from 48 to 56c. per ton exclusive of royalty. Where royalty has to be paid, it is usually 4 annas (8c.) per ton. Prices until of late have been low—as low as 64c. per ton at the pit's mouth. During the past two years, prices have risen considerably and $1.60 at the pit's mouth is probably the average at present.

The coal trade suffers greatly from the lack of rolling stock of the railway companies and the complaints in Calcutta are loud and insistent at present. To give an idea of the magnitude of the industry, it may be stated that the capital of the limited liability coal companies(excluding private concerns) is $17,000,000, while the present market value of their shares is nearly $90,000,000.

A National Bureau of Mines

During the recent annual convention held in Indianapolis, by the Mine Workers of America, a resolution was passed favoring the establishment of a national bureau of mines and mining. It was said that the dominant political parties had placed in their platforms strong declarations favoring such a bureau, but nothing had been done by the United States Senate to ratify the House bill passed in that body last May. The miners claim they have had reason to believe the measure would come through the Senate immediately upon the convening of Congress. Meanwhile, it is asserted that the death rate in mining is steadily increasing and the growing frequency of disasters due to poorly equipped mines are discreditable to the nation.

The plea of the miners is that congress inaugurate this work without further delay and restore confidence in political declaration as well as to accomplish what is universally believed should be done. It will be the duty of the bureau to investigate the causes of disasters and to seek out and enforce the means by which they can be prevented.

Coal Mining in Nevada

The principal supply of fuel used in the State of Nevada has heretofore been shipped from the mines in Utah and Wyoming; however, the new coal operations at Coaldale, Nev., are showing up so well that it is probable the State will soon have a considerable fuel output to supply part of its own needs. At one of the Coaldale operations a shaft is down 208 ft., and at the bottom shows about 42 in. of coal. It is stated that a thorough analysis made of this coal shows 57 per cent. carbon, 0.5 sulphur, and about 25 per cent. volatile matter.

The seams are not uniform in composition, since there are several streaks of good coal varying in thickness from 3 to 5 ft., and separated by partings of less desirable coal. On the surface in this same district, there are seven parallel seams which average in width from 8 to 80 feet.

If the Nevada operators succeed in producing a good grade of fuel, there is no question as to a ready home market. It is estimated that the Coaldale mines can transport coal to Blair Junction, the nearest railway point, for not more than $2 per ton; the railroad will haul the coal to Tonopah and Goldfield for $1.50 per ton. This would, therefore, enable the consumers to purchase coal at a price of approximately $10 per ton, which would be considerably less than the average price now paid.

There are many indications of coal throughout the entire region, and when the many oil concerns that are now drilling in the district have finished their borings, it is almost certain that their development work will disclose good coal seams of considerable area. It is stated by those who have visited the region that the coal here found will make a good grade of coke, and that the product will not slack when exposed to the elements.

The Instruction of Miners in Rescue Work

At the experimental station established by the United States Geological Survey at Urbana, Ill., the miners are taught how to escape from a mine when an explosion occurs and breathing is made impossible. Escape is effected by using a helmet which is kept near at hand, and a jar of oxygen, which is strapped on the back.

In making experiments the Government experts burn a quantity of sulphur in an air-tight room, which makes the atmosphere so obnoxious it is impossible for anyone to breathe. Men who enter wear helmets on their heads and carry enough oxygen in jars on their backs to last for two hours. As long as this oxygen lasts they are able to remain in the room without discomfort. Without this preparation a man could not enter the room and live to exceed one minute. Those who have entered the "death chamber" with helmet and oxygen breathed freely all the time.

The Indiana officials and operators are greatly interested in the rescue apparatus and will go to Urbana and visit the experimental station.

According to T. H. Holland, director, Geological Survey of India, coal is the most valuable mineral product of India. Fully 90 per cent. of the output is consumed in developing home industry, in 1906 the total valuation of the output at the mines being above $9,000,000. With the exception of about 5 per cent., all the coal produced comes from the Peninsula region where it occurs in the lower division of the Gondwana system. This corresponds approximately to the upper Carboniferous horizon. In other parts of India small bodies of coal are found in rocks of Tertiary age. The eastern Himalayan fields are the only known occurrence of Gondwana coal not in the peninsula.

Such items as government taxes, etc., that are out of the control of the technical management should be segregated from the operative costs that are used for comparisons of working costs.

Working Costs on the Rand

By W. Fischer Wilkinson*

There was at the Transvaal mines during the year 1908, a general reduction in the cost of working calculated on the tonnage basis. The statistics of the mines probably exaggerate the improvement in the economic conditions. In comparing, for instance, the working costs of any mine with those of previous years, it will be noticed that in many cases part of the improvement is due to charging a lower amount than formerly for development redemption. The average grade of ore worked was lowered and consequently a larger tonnage is available for mining for the same cost of development. The cost per foot may not have been reduced during the year, but the cost per ton has declined automatically owing to the lower grade extracted. It is important to remember, in considering the industrial situation, that the ton of today is not the ton that was mined last year or in former years. Part of the reduction, too, shown in the statistics is due to the increased scale of operations, the fixed charges, for example, being proportionately less per ton.

Making allowance, however, for these points, which made a reduction in costs more apparent than real, there was no doubt a general reduction in the costs due to increased efficiency. The policy now generally adopted of working on a large scale and of mining ore down to a minimum of profit certainly produces very low costs. Whether equally good results or better could not be obtained by raising the grade is an open question upon which the *South African Mining Journal* published during the early months of the year an interesting series of articles.

The accompanying table, compiled from the monthly statistics of the Chamber of Mines, shows the reduction in costs that was effected between January and September. This is the first year in which the Chamber has published costs and profits. They are, of course, costs and profits on working account and must not be taken to represent net profits.

There is, as remarked above, generally a wide difference between the working profits and the dividends, owing to deductions for profit tax, depreciation, interest on loans, debenture interest, etc. The real working costs are rather difficult to arrive at, owing to variations in practice in bookkeeping, but they are considerably more than the costs on working account, and have been estimated on an average at about 75 per cent. of the working profits.

An acompanying table, compiled from the returns of the Witwatersrand mines only, i.e., exclusive of the outside mines, illustrates the reduction in grade that has taken place since 1897 and gives the dividend profits per ton and the cost of working calculated as the difference between dividend and yield. It is, of course, not an accurate figure, as no allowance is made for profits appropriated to capital, and the figures have, therefore, only a relative value.

In order to illustrate the effect of large outputs in reducing costs, an accompanying table has been compiled from the returns for the month of August. The Randfontein mines are omitted:

REDUCTION IN GRADE, WITWATERSRAND MINES.

	Value per Ton.	Costs per Ton.	Dividend per Ton.
1897	39.7s	29.6s	10.1s
1898	41.3	28.0	13.3
1899	43.8	34.8	9.0
1903	39.8	28.8	11.0
1904	38.5	29.0	9.5
1905	35.8	27.2	8.6
1906	34.8	26.4	8.4
1907	34.0	25.0	9.0
1908*	31.8	22.6	9.2

*Estimated.

The seven largest mines are the Crown Deep, the Robinson, the Village Main Reef, the Knights Deep, the Robinson Deep, the Simmer & Jack, and the East Rand Proprietary, the latter a group of mines consolidated into one company.

Another table has been compiled from the statistics of the Rand Mines group to illustrate how reduced costs are obtained at the expense of grade. In five cases the reduction in costs is overbalanced by the reduction in yield. It should be mentioned that the Ferreira Deep operated 40 and the Langlaagte Deep 30 more stamps in 1908 than in 1907. While the net profit per ton is less in some cases, it must be remembered that the total available ore supplies of the mine are increased by the lowering of the grade. The figures are instructive and indicate that it is uneconomical to lower costs too far at the expense of grade.

COSTS AND PROFITS, WITWATERSRAND MINES.

1908.	Tons Milled.	Yield.	Working Costs.	Working Profit.
		s.	s.d.	s.d.
January	1,416,139	31.91	19.5	12.7
February	1,343,672	32.43	19.5	13.1
March	1,456,375	31.57	18.8	13.3
April	1,418,687	32.05	18.6	13.7
May	1,490,952	31.37	18.1	13.5
June	1,458,499	31.52	18.0	13.8
July	1,515,505	30.96	17.9	13.5
August	1,535,793	30.8	17.4	13.7
September	1,534,755	30.67	17.5	13.5

WORKING COSTS AND GRADE OF ORE PER TON MILLED, RAND MINES.

Mine.	Costs, Year Ending July, Sept. or Dec. 1907.	Costs Quarter, July or Sept. 1908.	Yield.		Reduction in Costs.	Reduction in Yield, 1 dwt.=4.2 s.
			1907, Dwt.	1908, Dwt.		
	s. d.	s. d.			s. d.	s. d.
Glen Deep	21	19 9	7.439	7.000	1 3	1 10
Geldenhuis Deep	19 8	18 11	7.085	6.712	9	1 7
Jumpers Deep	24 6	23 9	6.905	6.659	9	1
Nourse Mines	24	20 7	8.453	7.371	3 5	4 6
Rose Deep	18 8	16 4	6.563	6.266	2 4	1 3
Ferreira Deep	19 4	16 5	11.697	11.030	2 11	2 10
Crown Deep	19 3	14 11	9.226	8.240	4 4	4 2
Langlaagte Deep	23	18 1	7.062	6.350	4 11	3
Durban Roodepoort Deep	26 3	24 7	7.681	7.424	1 9	1 9

EFFECT OF LARGE OUTPUTS IN REDUCING COSTS.

Companies Milling Tons per Month.	Number of Companies	Yield.	Costs.	Profits.
Under 10,000	10	33.4s.	23.4s.	10.0s.
10,000 to 20,000	13	29.6	20.0	9.6
20,000 to 30,000	13	28.8	17.0	11.8
30,000 to 40,000	10	31.0	17.0	14.0
40,000 and upward	7	32.6	14.8	17.8

The City Deep and Brakpan mines developments (*Aust. Min. Stand.*, Dec. 23, 1908) clearly demonstrate that the Rand may confidently anticipate the recovery of high values from great depths. In the City Deep the reef was intersected at a vertical depth of 2865 ft., and to date the average reef width disclosed is 22.7 in.; the average value is 1 oz. 1.7 dwt. per ton. At Brakpan the conglomerates were cut in the No. 1 shaft at a depth of 3890 ft., and in the No. 2 shaft at 3695 feet.

*Mining engineer, London, England.

Note—This is a part of the article reviewing mining conditions on the Transvaal, published in the Journal of Jan. 9, 1909; it was omitted from that issue on account of lack of space.

The Verde Mine, Arizona

By George W. Maynard*

Doctor Douglas' interesting and instructive article in the Journal of Feb. 20, 1909, on the early history of the Copper Queen, suggests that a statement about the beginnings of another great mine in Arizona may prove of interest.

In September, 1879, I went to Arizona to examine a number of mines and prospects which Gen. Jno. C. Fremont, at that time governor of Arizona, had brought to the attention of New York capitalists. The Southern Pacific railroad then had no connection with eastern roads at the south, so that to reach Arizona one had to travel via San Francisco through California to Yuma and then east to Tucson which, for many months, was the terminus.

My destination was Prescott, at that time capitol of the territory, the nearest railway point to which was Maricopa, about 150 miles away. The stage was a canvas-covered hack of the variety known as a "jerky." We pulled out at 8 o'clock at night. The one other passenger was a Wells-Fargo messenger who produced a rifle after crossing the Gila, the reason being that the stage had been held up there a few nights before. The town of Phoenix, now the capital, consisted of about half a dozen adobe houses and the "Palace Hotel" a combination of canvas and planks. In comparison with other western mining towns Prescott was really attractive with its spacious plaza, court house and a general air of neatness.

For about two months my time was taken up in visiting neighboring mining districts and in the examination of more or less developed properties and prospects.

General Fremont accompanied me in nearly all of my trips, which were made with exceptional comfort due to the kindness of General Wilcox, then in command of Fort Whipple, who loaned us a roomy army ambulance, a span of big mules and a driver. The daily intercourse with General Fremont enlivened by his accounts of his early explorations will always be treasured as the most delightful experience of my early western work.

The work in the field was followed on our frequent returns to Prescott during the long evenings by the brilliant conversation and Washington reminiscences of Mrs. Jesse Benton Fremont, the daughter of Senator Benton. Taken altogether that two months in Arizona was equivalent to a liberal education.

Makes Examination

On the completion of the work for my New York clients and as I was about leaving Prescott, I was asked by one of the Prescott merchants if I would go into the Black Hills about 30 miles north of Prescott and look at a copper prospect which he owned there. As the statement about the property appealed quite strongly to General Fremont we made an early start one morning, the General's son Frank accompanying us. We reached the foot of the mountain in the evening and camped that night. The following morning we took to the saddle and soon reached the summit of a ridge from which we had a view of the Verde valley made brilliant by the rising sun, an experience which can never be blotted from one's memory.

As all of my note books and copies of reports bearing upon my Arizona work at that time are buried in a store house I have to rely upon my memory for the following details of the examination. The outcrop and definition of the vein on the narrow plateau on the summit of the ridge was most impressive from a miners standpoint. The outcrop projected well above the surrounding surface, and was made up of malachite, azurite, chrysocolla and cuprite, a veritable flower garden, for a width of 15 ft. There had been but little surface stripping. For a short distance down the hillside the outcrop was readily traced but was finally lost sight of under a heavy growth of chaparral. The strike of the vein was apparently across a gulch but could not be definitely traced without tools for cutting down the undergrowth and breaking up the surface. About 100 ft. vertically below the outcrop an adit about 50 ft. in length had been driven 5 or 6 ft. into the vein at right angles to the strike. My impression is that it had not passed through the vein. In this crosscut there was considerable chalcopyrite and some chalcocite.

The outcrops and also the ore in the adit were sampled, in the latter case the copper sulphides being separately assayed. The assays showed no precious metals in the oxidized ores, but did give 10 oz. silver (with no gold) in the sulphides.

On my return to Prescott I informed the owner that he undoubtedly had the making of a good mine but that as it was a smelting proposition nothing could be done at present, for the reason that there was no fuel in the country and ore could not be shipped when the nearest railway was 180 miles distant. As the Atlantic & Pacific road, now the Santa Fe, was beginning to be talked about I advised him to hold on. To this he responded "I am hard up and if you can let me have $10,000 within the next 60 (?) days I will deed you a half interest in the mine."

On the strength of this proposition I sent a statement of my investigation to a party in New York, who with others was to pay me in about 90 days a considerable sum of money for some steel patents, asking for an advance of $10,000 on account for the purpose of securing the half interest in the mine.

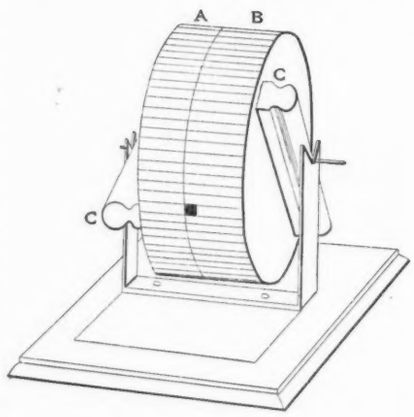
The telegraphic answer to my letter read; "Take my advice and have nothing to do with mines."

That mine is the "United Verde."

*Consulting mining engineer, 20 Nassau street, New York.

Multi-Cipher Device

James Trevor in the *Aust. Min. Stand.*, Nov. 18, 1908, describes a multi-cipher device devised by him and shown in an accompanying illustration. This device consists of two cylinders mounted loosely on an axle, but so arranged that they can be securely clamped together in any position. The axle rests in standards on a base board. In the illustration, *A* is the cylinder on which are the code words; *B* the one on which is the key to the code. *C* is a handle for aiding in turning the cylinders. In case one pair of cylinders is not enough other pairs of cylinders can be mounted on the same axle. A certain



MULTI-CIPHER DEVICE

phrase in the key is always selected as the one opposite which the keyword of the code is to be clamped. Each message is prefaced by a key word so that for each message the code is changed. This prevents easy deciphering of the code used, and the message can be read more easily than if a book has to be used.

The rock temperature in Bendigo mines, according to the report for 1907 of A. H. Merrin, chief mining inspector for Victoria, Australia, increases at the rate of 1 deg. F. for each 75 ft. below the zone of invariable temperature. At 4000 ft. the temperature due to the heat of the rocks is 110 deg. F. At this depth the temperature of the water issuing from the rocks is 114 deg. F. Under average underground conditions, when there is water in the downcast shaft, the actual temperature in the stopes will be somewhere between 75 deg. and 110 deg. F., depending upon the quantity of air entering the stope and the length of time the air is in contact with the rock before entering the stope.

Conserving Labor

Nothing could be more hopeful than the awakened interest in the preservation of our natural resources. We could not wish to discredit it; but it may be pertinent to ask, says *The Evening Post,* whether we understand what our real resources are, and whether we are not overlooking our most destructive forms of waste. Corresponding to the economist's three factors of production, there are three conspicuous forms of waste—waste labor, waste land, and waste capital. The greatest of these is waste labor, but it is the form of waste which is least understood and appreciated. It is the most important because it is the human factor which is being wasted, and the human factor has always and everywhere been the greatest factor in the production of wealth. Communities have grown rich in poor environments, and poor in rich environments, but no community ever grew rich while wasting its human energy; and it is doubtful if any community ever remained poor which utilized and conserved its labor power. Labor power, of course, includes mental as well as physical energy. That waste labor power is the form of waste least considered is shown by the fact that a great many people, perhaps a majority, not only do not deprecate it, but actually think it a good thing. A leisure class to consume the products of the workers is thought by many to be an economic necessity.

Of waste labor there are four principal kinds—the unemployed, the improperly employed, the imperfectly employed, and the voluntarily idle. Of these the least important is the unemployed, though it alone has received much attention. It is the least important because, first, it is normally and on the average the least efficient labor which remains unemployed; second, because the utilization of the labor power which is now going to waste at the upper end of the social scale will go a long way toward solving the problem of unemployment at the lower end of the scale.

By improperly employed labor is meant that which is engaged in acquiring rather than producing wealth. Enterprises whose sole purpose is to cause two dollars to emerge from the pockets of other men where one had emerged before, absorb a considerable fund of energy which ought to be concerned with blades of grass and similar things. It is unnecessary to mention the thief, the counterfeiter, the confidence man and the blackmailer. Their activities are already regarded as predatory rather than productive, and the law is doing what it can to stop them. From the economic point of view, however, there is no great difference between the counterfeiter and the adulterator of food and drugs, or the manufacturer of shoddy; between the confidence man and the promoter of overcapitalized corporations; or between the blackmailer and a certain type of advertising agent who persuades you to advertise with him, not because it will do you any good, but because it will save you from harm. A really productive enterprise carried on by purely productive methods increases the wealth in the hands of other people in proportion as it is successful; and in proportion as a man grows rich in such an enterprise by such methods, he makes the country richer instead of poorer. The law-giver who can turn all our labor power, mental and physical, into such channels, will make the country so productive that nothing short of a foreign invasion or a geological cataclysm could prevent us from becoming rich, even if our material resources were as meager as those of New England.

By imperfectly employed labor is meant that which is employed productively, but less productively than it might be. Wherever there is a man doing unskilled work who might, had he received the proper training, be doing skilled work, or doing skilled manual work who might be doing the more highly skilled and more needed work of managing and directing, there is a case of imperfectly employed labor. It is as great a waste of productive energy as it would be to have good garden land used for pasturing long-horned steers. Here, again, is a statesman's opportunity for enriching his nation, by providing the means for economizing to the greatest degree the labor power of the people. Much of it is now going to waste, in the sense that it has to be utilized in ways which are of little value, merely because of its over-supply, while other kinds of work are suffering because of the scarcity of competent men. An industry can expand only so far as its rarest factor will permit. The rarest factor is managing ability, and any policy, educational or moral, which will increase the supply of managing ability will enable industry to expand and to absorb greater numbers of the unemployed.

The voluntarily idle are of two classes —those who have retired on a well-earned competence, and those who live on wealth which they themselves have never earned. The first class does not trouble us much in America. The American business man's habit of continuing to work after having accumulated enough to provide for all his possible wants is singularly economical of human energy, provided, of course, that his is a productive or really useful business. The longer he remains active, the greater the fund of productive energy at work in the community and the richer the community will grow. It is, of course, unnecessary to say that no one is idle who is fully occupied with some useful work, even though he be not actually earning his living by it. Until recently, we have not been very much troubled with the second class, but our own prosperity is creating it and we need to look to the future. Here is another challenge to the constructive statesman. The loss of this kind of labor power is especially regrettable, because it is usually labor power of the very highest type which goes to waste in this form. It is the kind of power, which, if set to work, would increase the supply of the scarcest factor in the creation of wealth, both material and immaterial, and which would, therefore, strengthen society precisely where it is now weakest, and contribute most to our national prosperity.

The Arizona Copper Company, Ltd.

The annual statement for the year ended Sept. 30, 1908, of the Arizona Copper Company, Ltd., submitted to the stockholders in Edinburgh on Feb. 24, 1909, covers the operations of the Arizona Copper Company, Ltd., the Arizona Copper Company, of Arizona and the Arizona & New Mexico Railway Company. Profits for the year amounted to £288,138; and the surplus, after deducting preferred dividends, was £173,607. The balance brought forward from the previous year increased this surplus to £222,064 after carrying £90,000 to the reserve account. Out of the surplus the directors reccommend that $189,987 be paid in additional dividends.

The production of copper was 33,980,291 lb., which is greater than that of any previous year. The total ore mined amounted to 751,220 tons, 43.3 tons of ore being required for the production of one ton of copper. The first-class smelting ores yielded 6.64 per cent. copper while the concentrating ores gave 2.1 per cent.

Improvements included the installation of a new dust flue at the smelter and development work during the last half year amounted to 17,095 ft., exposing a large tonnage of low-grade ore and a fair amount of higher grade.

Some stocks of French coal companies sell at high prices. Thus a recent market report shows sales of Courrieres, par value 100 fr., at 2900 fr. per share; the dividend for last year being 80 fr. Douchy, par 200 fr., dividend 50 fr., brought 1055 fr.; Ostricourt, par 500 fr., dividend 50 fr. sold for 2375 fr.; Grand' Combe, par 250 fr., dividend 50 fr., sold for 1465 fr. The returns on the selling price at the rate of last year's dividends ranged from 2.1 to 4.7 per cent. Only expectations of a higher dividend rate would warrant some of the quotations.

Mine Labor and Accidents in the Transvaa

The number of laborers of all classes, skilled and unskilled, employed at mines and mills in the Transvaal at the close of 1908 was as follows:

Mines:	White.	Negro.	Chinese.	Total
Gold	19,605	164,826	12,275	196,706
Coal	426	9,048	.....	9,474
Diamonds	799	7,803	.....	8,602
Other	447	3,776	.....	4,223
Total	21,277	185,453	12,275	219,005

White labor was 9.7 per cent. of the total; Kafir, 84.7; Chinese, 15.3 per cent. In December there were 159 separate accidents reported, the casualties from which were as follows:

Number:	White.	Negro.	Chinese.	Total.
Killed	8	69	2	79
Injured	25	92	3	120
Total	33	161	5	199
Per 1000 employees.				
Killed	0 38	0.37	0.16	0.36
Injured	1.17	0.49	0.24	0.91
Total	1.55	0.86	0.42	1.27

During the year 1908, there were 777 persons killed and 1231 injured, a total of 2008 persons. Of the killed 65 were white men, 615 negroes and 97 Chinese; the respective proportions being 8.3 whites, 79.2 negroes and 12.5 per cent. Chinese.

Mr. Matthewson and the Smoke Case

BY F. T. HAVARD*

In the conference of the counsel with Judge Hunt in the Anaconda smoke case, Mr. Matthewson described in detail and with much lucidity, the processes in use for recovering arsenic from the smeltery fumes and dealt with the advantages, and the more numerous disadvantages of the methods proposed for overcoming what the farmers style the "smoke nuisance." Mr. Matthewson said that the arsenic in the ores varied all the way from minimum quantities to 2½ per cent., usually occurring in but small quantities. He stated further, that 90 per cent. of the ore which come to the smelter is sent to the concentrator where 50 per cent. of the arsenic is removed and thrown on the dump. Of the arsenic which reaches the smeltery in the ore, some is dumped with the furnace slags, a part is recovered in refinery drosses, and the rest goes into the flue in the form of white fume, consisting principally of the oxides. He told how the arsenic is recovered from the fumes by redistillation and recovery, and advanced the statement that the method employed at Washoe is the most thorough known. In reply to a question from Mr. Kelley, the attorney of the Amalgamated, Mr. Matthewson said that there are only two other smelters in the United States which collect the arsenic from the fume, one being at Everett and one at Salt Lake.

In telling the court of the methods by which arsenic might be extracted, Mr. Matthewson classified the methods used as follows: *A*—Cooling processes: (1) water spray; (2) admission of air; (3) radiation; (4) freezing. *B*—Filtering processes: (1) bag house; (2) friction; (3) centrifugal gas cleaners. *C*—The Cottrell method. In commenting on the spraying method he emphasized the difficulty of disposing of the acid mud formed, and stated that a plant sufficient for the Washoe smeltery would cost $3,000,000. He disposed of the bag-house method by saying that a sufficiently capacious plant would cost $2,750,000, that the expense of its operation will amount to $1850 per day, with a recovery of arsenic to the value of $204, and that the life of the bags would be short. The installation of a radiation-cooling system would cost, in his estimation, $1,200,000, and would not be efficient. For the freezing system the pipes alone would cost $4,000,000, and the cost of operation would amount to $10,800 per day. The system, further, has not proved practicable. A plant using zinc oxide as a neutralizer would cost $3,000,000, and would require 500 tons of zinc ore daily. With regard to the Cottrell method, Mr. Matthewson said that its application was not practicable on a commercial scale, except under very peculiar conditions.

He concluded that if the friction system now used at Great Falls were successful, Anaconda would adopt it, although its installation should cost $2,000,000. Judge Hunt and Mr. Matthewson both stated that they had received many letters embodying schemes for collecting the arsenic, but in Mr. Mathewson's opinion, the men who had made the suggestions seldom realized the quantity of fume to be treated, and that consequently the ideas are of little value.

*Mining engineer, Helena, Mont.

Steel Production in 1908

The production of open-hearth steel in the United States in 1908, as collected and published by the American Iron and Steel Association, was as follows, in long tons, comparison being made with the returns for 1907:

	1907.	1908.	Changes.
Acid	1,270,421	696,304	D. 574,117
Basic	10,279,315	7,084,568	D. 3,194,747
Total	11,549,736	7,780,872	D. 3,768,864

The total decrease in 1908 was 32.6 per cent. Acid steel was 8.9 per cent. of the total, and basic 91.1, in 1908; the proportions in 1907 being 11 and 89 per cent., respectively. Included in the totals for 1908 are 311,777 tons of direct castings, of which 156,772 tons were acid and 155,005 tons basic steel. This quantity of direct castings was 434,748 tons less than in 1907.

While the open-hearth production in 1908 was considerably smaller than in 1907, it was much larger than the production of bessemer-steel ingots and castings in 1908, the output of open-hearth steel in that year exceeding that of bessemer steel by 1,664,117 tons, or over 27 per cent. This is the first time that the production of open-hearth has exceeded that of bessemer steel.

The production by States for two years past was as follows:

States.	1907.	1908.
New England	239,797	158,417
N. Y. and N. J.	706,019	350,348
Pennsylvania	7,868,353	5,266,372
Ohio	819,642	525,171
Illinois	1,013,251	483,104
Other states	902,674	997,460
Total	11,549,736	7,780,872

Pennsylvania made over 67.2 per cent. of the total production of basic-steel ingots and castings in 1908, and over 71.8 per cent. of the total production of acid steel against over 66.4 per cent. of basic and over 82 per cent. of acid ingots and castings in 1907. Ohio, Illinois, Alabama, Colorado and New York, in the order named, were the next largest producers of open-hearth steel in 1908.

The open-hearth steel made in 1908, including both ingots and castings, was produced by 125 works in 21 States and the District of Columbia. In 1907 there were 137 works in 20 States and the District of Columbia, which made open-hearth steel. During 1908 there were 40 open-hearth steel works which did not make steel, as compared with 25 works in the preceding year.

TOTAL STEEL PRODUCTION

The total steel production of the United States desregarding crucible steel, which has never exceeded 1 per cent. in any one year, has been as follows for 10 years past, in long tons:

	Bessemer		Open-hearth		Total
	Tons.	Per Ct.	Tons.	Per Ct.	Tons.
1899.	7,586,354	72.0	2,947,316	28.0	10,533,67g
1900.	6,684,770	66.3	3,398,135	33.7	10,082,900
1901.	8,713,302	65.2	4,656,309	34.8	13,369,611
1902.	9,138,363	61.6	5,687,729	38.4	14,826,092
1903.	8,592,829	59.6	5,829,911	40.4	14,492,740
1904.	7,859,140	57.1	5,908,166	42.9	13,767,306
1905.	10,941,375	55.0	8,971,376	45.0	19,912,751
1906.	12,275,830	52.8	10,980,413	47.2	23,256,243
1907.	11,667,549	50.2	11,549,736	49.8	23,217,385
1908.	6,116,755	44.0	7,780,872	56.0	13,897,627

The make of bessemer steel in 1908 was smaller than that of any other year given in the table. The production of open-hearth steel, on the other hand, though less than that of any given year since 1904, was greater than that of 1904, or any preceding year. The total steel output was less than that of any year since 1901, with the sole exception of 1904.

The ratio of the total steel to pig-iron production was 87.2 in 1908, against 90.1 in the preceding year.

During the first 11 months of 1908, an average of 8981 stamps were dropping on the Rand, and the average duty per 24 hours per stamp was 6.21 tons.

The Mineral Production of Canada in 1908

Total Mineral Production of Dominion in 1908 Valued at $87,323,-849. Gain in Silver, Gold and Copper. Other Substantial Advances

BY JOHN McLEISH*

The following tables and comments give a full preliminary report on the mineral production of Canada in 1908. The figures of production given are, of necessity, subject to revision, since at this time, in many instances, producers of metallic ores have not themselves received complete returns from smelters. For these and other reasons estimates have to be made. It is hoped, however, that this preliminary statement may give a fair idea of the gross output of the mineral industry during the year. Acknowledgments are due to the various operators who have promptly furnished statements of their production, to the provincial mineralogist of British Columbia for a complete preliminary statement of mineral production in that Province, and to the other provincial mining bureaus for assistance rendered.

The value placed upon the mineral production of the Dominion since 1886, when complete reports were first prepared, has been as follows:

1886.....	$10,221,255	1898.....	$38,412,431
1887.....	10,321,331	1899.....	49,234,005
1888.....	12,518,894	1900.....	64,420,983
1889.....	14,013,113	1901.....	65,804,611
1890.....	16,763,353	1902.....	63,211,634
1891.....	18,976,616	1903.....	61,740,513
1892.....	16,623,415	1904.....	60,073,897
1893.....	20,035,082	1905.....	69,525,170
1894.....	19,931,158	1906.....	79,057,308
1895.....	20,505,917	1907.....	86,842,765
1896.....	22,474,256	1908.....	87,323,849
1897.....	28,485,023		

The total value in 1908 was, approximately, 8½ times that shown in 1886. The increase in 1908 over 1907 was 0.5 per cent.; over 1906, it was 10.4 per cent.

This preliminary review of the mineral production in Canada in 1908 shows that the industry has in the aggregate more than held its own despite the large decreases in the prices of metals. That this falling off in prices has been an important and serious question for the metal-mining industries, will be better realized when it is stated, that had the metals, copper, silver, lead and nickel, maintained as high average prices in 1908 as in 1907, their total production in Canada in 1908 would have been worth over $8,000,000 more to the producers than was actually the case.

The important feature of the mining industry during the year was undoubtedly the silver production, a total increase of over 72 per cent. being shown in the number of ounces produced. The metals, copper and gold, also show the important increases in quantity produced

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MINERAL PRODUCTION OF CANADA IN 1908.

Product.	Quantity.	Value.
METALLIC.		
Copper..... Lb.	64,361,636	$ 8,500,885
Gold..... Lb.	.....	9,559,274
Pig iron from Canadian ore.....Tons.	99,420	1,664,302
Lead ..... Lb.	45,725,886	1,920,487
Nickel..... Lb.	19,143,111	8,231,538
Cobalt..... Lb.	1,853,286	112,253
Silver..... Oz.	22,070,212	11,667,197
Total value, metallic.	.....	$41,655,936
NON-METALLIC.		
Arsenic.....Tons.	699	38,054
Asbestos.....Tons.	65,534	2,547,507
Asbestic and asbestic sand.....Tons.	25,239	25,829
Calcium carbide..Tons.	6,864	417,150
Chromite.....Tons.	7,225	82,008
Coal.....Tons.	10,904,466	25,567,235
Corundum.....Tons.	1,039	100,389
Feldspar.....Tons.	7,877	21,099
Graphite.....Tons.	251	5,565
Grindstones.....Tons.	3,843	45,128
Gypsum.....Tons.	340,964	575,701
Limestone for flux in iron furnace....Tons.	418,661	289,705
Magnesite.....Tons.	120	840
Mica.....Tons.	.....	191,602
Mineral pigments—		
Barytes.....Tons.	4,091	18,265
Ochres.....Tons.	4,746	30,440
Mineral waters...Tons.	.....	109,391
Natural gas .....Tons.	.....	1,012,060
Petroleum ..... Bbl.	527,987	747,102
Phosphate (apatite) Tons.	1,596	14,794
Pyrites.....Tons.	47,336	224,824
Quartz.....Tons.	27,134	32,277
Salt.....Tons.	79,975	378,798
Talc.....Tons.	1,076	3,048
Tripolite.....Tons.	30	195
Total value, non-metallic.....	.....	$32,479,006
STRUCTURAL MATERIAL AND CLAY PRODUCTS.		
Cement, natural..Bbl.	1,044	815
Cement, Portland. Bbl.	2,665,289	3,709,063
Flagstones..... No.	4,000	3,600
Sand and gravel (exports).....Tons.	298,954	161,387
Sewer pipe.....	.....	514,042
Clay products, stone, lime, etc., est.....	.....	8,500,000
Total structural and clay products.....	.....	$12,888,907
Estimated value of mineral products not reported.....	.....	300,000
Total value, 1908....	.....	$87,323,849

while iron, lead and nickel were produced in slightly smaller quantity than in 1907.

In the non-metallic class, decreases in gypsum and petroleum are more than counterbalanced by increases in coal, asbestos, natural gas, salt, etc. The portland-cement industry shows a small increase in sales and a large increase in quantity of cement made with large stocks on hand at the close of the year.

It should be noted that the valuation of the metals is based on New York prices, as reported by THE ENGINEERING AND MINING JOURNAL.

Some remarks are added on the details of production of the leading articles for the year.

GOLD

For the first time in nine years the gold output shows an increase over the previous year. The Yukon output in 1908 is estimated at about $3,600,000, as compared with $3,150,000 in 1907, while a considerably increased production is also shown in the province of British Columbia, derived chiefly from the Trail Creek ores, the placer workings having shown a smaller output. In Nova Scotia the output in 1907 was $282,686. Complete returns are not yet available for 1908, but the output was probably not over $225,000. Of the total gold output in 1908, over 44 per cent. was obtained from placer and hydraulic workings and 56 per cent. from sulphuret and quartz ores.

SILVER

The estimated silver production of Canada in 1908 was 22,070,212 oz., shipped as fine bars, silver bullion, and obtained in matte, ore, etc., as compared with 12,-779,799 oz. in 1907, an increase of over 72 per cent. Owing, however, to the much lower price received in 1908, the total value shows an increase of only 40 per cent. Over 87 per cent. of the output was obtained from Ontario, and the increase is all to be credited to this province, since there was a slight falling off in the silver output of British Columbia.

The output from the Cobalt district in the province of Ontario again shows a very large increase over the previous year, nearly twice as much silver having been produced. Returns from 29 shipping mines show the ore and concentrates shipped, as approximately 25,497 tons, containing 19,296,430 oz. silver, as compared with 14,644 tons containing 9,982,363 oz. in 1907. Valued at the average price of refined silver for the year, the production in 1908 would be worth $10,200,865, and it represents an average return of 756 oz. of silver or $400 per ton of ore shipped as compared with an average return of 681 oz. of silver, or $445 per ton of ore shipped in 1907.

If the output of this district continues to increase at the present rate, Canada will in the immediate future, become one of the chief silver-producing countries of the world. In 1908, it held probably the third place and furnished about 12 per cent. of the world's output.

COPPER

Statistics of copper production in 1908 show a total output of 64,361,636 lb., an

increase of over 14 per cent. over the production of 1907. There was an increase of over 900,000 lb. in the copper from the Sudbury mines, while preliminary statistics of production in British Columbia appear to show an important increase in production of over 7,000,000 lb. The total exports of copper in ore, matte and blister, were 25,568 tons.

Lead

All of the lead production shown in the general table, 45,725,886 lb., was obtained in the province of British Columbia. The production in 1907 was 47,738,703 lb., valued at $2,542,086; a decrease in quantity being shown of about 4 per cent. The total amount paid as bounty on lead production was, during the twelve months, $139,064. The exports of lead in ore, etc., during the year were 2256 tons, and of pig lead 6971 tons, or a total of 9227 tons.

Nickel

With the exception of the nickel contained in the ores shipped from the Cobalt district, the production of nickel in Canada is derived entirely from the well-known nickel-copper deposits of the Sudbury district. Previous to 1906 the output had been increasing steadily for a number of years. During the past three years, however, the production has not varied very greatly. About 815 tons less matte was shipped in 1908 than in 1907. The nickel contents were also somewhat lower in 1908, averaging about 45.1 per cent. as compared with 48.1 per cent. in 1907. On the other hand the copper contents were higher in 1908.

Two companies are carrying on active operations: the Mond Nickel Company, at Victoria Mines, and the Canadian Copper Company, at Copper Cliff. The ore is first roasted and then smelted to a bessemer matte containing from 77 to 80 per cent. of the combined metals, copper and nickel, which is shipped to the United States and Great Britain for refining.

The accompanying table gives the results of the operations on the nickel-copper deposits of Ontario in 1906, 1907 and 1908, in short tons.

According to Customs returns exports of nickel in matte, etc., were, for twelve months ending Dec. 31, as shown in an accompanying table.

These figures do not include the nickel contents of the silver-cobalt ores from the Cobalt district, of which it is difficult to obtain satisfactory returns. The shippers of silver-cobalt ores receive little or no return for the nickel contents, although this metal forms an important constituent of the ore.

Iron and Steel

The total shipments of iron ore from mines in Canada in 1908 were 203,490 short tons, valued at the mine at $486,857 as compared with 312,496 tons valued at $666,941 in 1907. The greater part of this production was from the Helen mine, Michipicoten, delivered to Midland and Hamilton. During 1908 very little Canadian ore was exported.

Pig Iron—The total production of pig iron in Canada in 1908, from both Canadian and imported ores, according to direct returns from nine plants comprising 16 furnaces, was 630,835 short tons, valued at $8,111,194, as compared with 651,962 tons, valued at $9,125,226 in 1907. These figures do not include the output from the two electric furnace plants, making ferro-products, which are situated at Welland, Ont., and Buckingham, Quebec. Of the total during 1908, 6709 tons, valued at $171,383, were made with charcoal as fuel, and 624,126 tons, valued at $7,939,811, with coke.

The amount of Canadian ore, including mill cinder, etc., used was 219,266 tons, while the quantity of imported ore was 1,051,445 tons. The total amount of coke used during the year was 817,746 short tons valued at $1,770,320. The total amount of charcoal used was 1,121,990 bu., valued at $85,738. The quantity of limestone flux charged was 483,065 tons. The plant of the Atikokan Iron Company, Ltd., was out of commission throughout the year, while a number of others were operated for a part of the year only. The blast furnace at Londonderry was in blast for little over a month and the furnace of the Deseronto Iron Company, Ltd., for about two months.

Steel—The returns from eight companies making steel showed a total output as in the accompanying table.

A statement of the bounties paid on iron and steel during the calendar year, furnished by the Trade and Commerce Department, is also given.

The rates of bounty issued were the same in both years.

Asbestos

Returns of shipments of asbestos from the eastern townships, province of Quebec, were received from 12 operating companies, which employed 2643 men in mine and mills and paid in wages $1,002,768. Several other companies were engaged in development work and preparing to make shipments during the coming year. The total shipments divided into crude and mill stock in 1907 and 1908 are given in the accompanying table.

Exports of asbestos from Canada were: 1906, 59864, value, $1,689,257; 1907, 56,753, $1,669,299; 1908, 61,210 tons, of $1,842,763 value.

Coal and Coke

Each of the coal-mining provinces except British Columbia, contributed an increased output to the coal production in Canada in 1908. The total shown includes colliery consumption and coal used in making coke. Of the total, Nova Scotia contributed over 59 per cent. Saskatchewan and Alberta over 19, and British Columbia 21 per cent. The production by provinces is given in the accompanying table, in short tons.

The total production of oven coke in 1908 was approximately 865,257 short tons, valued at $3,668,974, being an increase of about 3 per cent. over the quantity produced in 1907. The coke was made in the provinces of Nova Scotia, Alberta and British Colombia and entirely from Canadian coal. At the end of the year there

NICKEL PRODUCTION.

	1906.	1907.	1908.
Ore mined	343,814	351,916	409,551
Ore smelted	340,059	359,076	360,180
Bessemer matte produced	20,364	22,041	21,197
Bessemer matte shipped	20,310	22,025	21,210
Copper contents of matte shipped	5,265	6,996	7,503
Nickel contents of matte shipped	10,745	10,595	9,572
Spot value of matte shipped	$4,628,011	$3,289,382	$2,930,989
Wages paid	1,117,420	1,278,694	1,286,265
Men employed	1,417	1,660	1,690

NICKEL EXPORTS.

	1906.	1907.	1908.
To Great Britain	2,716,892	2,518,338	2,554,486
To United States	17,936,953	16,857,997	16,865,407
Total	20,653,845	19,376,335	19,419,893

STEEL PRODUCTION.

	1907.		1908.	
	Tons.	Value.	Tons.	Value.
Ingots—Open hearth (basic)	459,240	$9,157,703	443,442	$6,001,277
Bessemer (basic)	225,989	4,293,791	135,557	2,535,287
Castings—Open hearth (acid and basic)	20,602	2,031,380	9,051	617,126
Other steels	1,151	129,716	713	79,912
Total	706,982	$15,612,590	588,763	$9,233,602

IRON AND STEEL BOUNTIES PAID.

	1907.		1908.	
	Tons.	Bounty.	Tons.	Bounty.
Pig from Canadian ore	95,915	$201,421	101,647	$213,458
Pig from imported ore	537,803	591,584	517,427	569,170
Total, pig iron	633,718	$793,005	619,074	$782,628
Steel ingots	666,590	1,099,873	556,289	917,877
Steel wire rods	68,738	412,417	49,630	297,779
Total bounty paid	.....	$2,305,295	.....	$1,998,284

were in Nova Scotia about 659 ovens in operation and 173 idle; in Alberta and British Columbia on the same date 916 in operation and 528 idle, not including the ovens at Hosmer and Comox in British Columbia, from which no returns have yet been received.

Petroleum and Natural Gas

The production of crude petroleum is, as usual, practically all derived from the Ontario peninsula. Direct returns from the producers have not been obtained, but the production has been estimated on the basis of the bounty of 1½c. per gal. paid by the Dominion Government. The total bounty paid in 1908 was $277,193, representing a production of 527,987 bbl., compared with a bounty of $414,158 in 1907 representing 788,872 bbl. A decreased production of 33 per cent. is, therefore, shown.

Natural gas was produced in the counties of Welland, Haldimand, Norfolk, Kent, Essex and Bruce, in Ontario and at Medicine Hat, Alberta; the sales from the Ontario fields constituting over 95 per cent. of the total. The total receipts from gas sold in 1908 show an increase of about 24 per cent. over the receipts of 1907 and are now larger than at any time since the gas was first used.

Cement

Complete statistics of cement production in 1908 have been received from 23 operating plants. The total daily capacity of the 23 plants was about 27,500 bbl. as compared with an operating capacity of 14,300 bbl. in 1907. The operating plants were distributed as follows: One each in Nova Scotia, British Columbia and Manitoba, the latter manufacturing a natural portland, two in Alberta, three in Quebec province and 15 in Ontario. Of the 23 operating plants, 12 use marl and clay, 10 use limestone and clay, and one blast-furnace slag.

Detailed statistics of production in 1907 and 1908 are as follows:

	1907. Barrels.	1908. Barrels.
Portland cement sold	2,436,093	2,665,289
Portland cement manufactured	2,491,513	3,495,961
Stock on hand, Jan. 1	299,015	383,349
Stock on hand, Dec. 31	354,435	1,214,011
Value of cement sold	$3,777,328	$3,709,063
Wages paid	956,080	1,274,638
Men employed	1,786	3,029

The average price per barrel at the works in 1908 was $1.39 as compared with $1.55 in 1907. The imports of portland cement into Canada during the 12 months ending November, 1908, were 1,600,934 cwt. valued at $530,209. This is equivalent to 457,408 bbl. of 350 lb. at an average price per barrel of $1.16. The imports in 1907 were equivalent to 672,630 bbl. valued at $837,520, or an average $1.24½. The duty is 12½c. per 100 lb. There is very little cement exported from Canada, the consumption is, therefore, practically represented by the Canadian sales together with the imports.

ASBESTOS PRODUCTION.

	1907. Tons	1907. Value.	1908. Tons.	1908. Value.
Crude	4,327	$830,633	3,346	$692,232
Mill stock	57,803	1,654,135	62,188	2,855,275
Total asbestos	62,130	$2,484,768	65,533	$2,547,507
Asbestic and asbestic sand	28,296	20,275	25,239	25,829
Total products	90,426	$2,505,043	90,772	$2,573,386

COAL PRODUCTION IN CANADA.

Province.	1907. Tons.	1907. Value.	1908. Tons.	1908. Value.
Nova Scotia	6,354,133	$12,764,999	6,539,866	$13,138,124
New Brunswick	34,584	77,814	60,000	135,000
Saskatchewan	151,232	252,437	130,000	214,500
Alberta	1,591,579	3,836,286	1,845,000	4,899,611
British Columbia	2,364,898	7,390,306	2,329,600	7,280,000
Yukon	15,000	60,000	.....	.....
Total	10,511,426	$26,381,842	10,904,466	$25,567,235

An estimate of the Canadian consumption of portland cement for the last five years follows: 1904, total, 1,694,988 bbl., of which 784,930 bbl. were imported; 1905, 2,264,106, imported 917,558; 1906, total, 2,814,267; imported, 694,503; 1907, total, 3,108,720, imported 672,630; 1908, total, 3,122,697 bbl., of which 457,408 bbl. were imported.

Exports of Mineral Products

Exports of metals and minerals from Canada for the year are reported by the Customs Department as follows:

Arsenic	Lb.	1,913,732	$43,493
Asbestos	Tons.	61,210	1,842,763
Barytes	Cwt.	3,509	13,690
Chromite	Tons.	4,571	56,864
Coal	Tons.	1,729,833	4,661,377
Feldspar	Tons.	9,524	34,045
Gold	.....	.....	7,740,918
Gypsum	Tons.	280,091	324,574
Copper, fine in ore, etc	Lb.	51,136,371	5,934,559
Lead in ore, etc	Lb.	4,511,931	153,394
Lead, pig, etc	Lb.	13,942,663	469,060
Nickel, in ore, etc	Lb.	19,419,893	1,866,624
Silver, in ore, etc	Oz.	20,884,451	12,403,482
Platinum, in ore concentrates, etc	Oz.	43	937
Mica	Lb.	580,195	198,839
Mineral pigments	Lb.	249,635	4,850
Mineral water	Gal.	8,953	3,659
Oil, refined	Gal.	25	296
Ores, antimony	Tons.	149	5,647
Ores, iron	Tons.	4,334	72,260
Other ores	Tons.	13,910	509,779
Phosphate	Tons.	1	30
Plumbago	Cwt.	7,706	10,159
Pyrites	Tons.	17,283	96,600
Salts	Lb.	527,229	3,840
Sand and gravel	Tons.	298,954	161,387
Slate	Tons.	10,709	2,539
Stone, ornamental	Tons.	1,314	28,777
Stone, building	Tons.	4,009	14,034
Stone, for manufacture of grindstones	Tons.	661	5,991
Other products of the mine	.....	.....	176,007
Total value			$36,850,474

In addition there were manufactures exported to a total value of $2,940,379; the important items of value being $1,169,673 for manufactured steel; $399,785 for 194,546 lb. aluminum; $248,759 for 58,708 tons coke.

February Dividends

The accompanying table shows the dividends paid in February, 1909, by mining and industrial companies in the United States and by some foreign mining companies:

U. S. Mining Companies.	Location.	Amt. per Share.	Amount Paid.
Amal. Copper	Mont.	$0.50	$769,439
Bunker Hill Sull.	Ida.	0.25	75,000
Camp Bird	Colo.	0.24	196,800
Colorado	Utah	0.08	80,000
Elkton Con., M. and M.	Colo.	0.01½	37,500
Homestake	S. Dak.	0.50	109,200
International Nickel, pfd.	N. Y.	1.50	133,689
Mohawk	Mich.	2.00	200,000
United Verde	Ariz.	0.75	225,000
Utah (*Fish Sp's*)	Utah	0.02	2,000
Total			$1,828,628

Foreign Mining Companies.	Location.	Amt. per Share.	Amount Paid.
Buffalo Mines, Ltd	Ont.	$0.01	$10,000
Cobalt Central	Ont.	0.02	95,230
Dolores	Mex.	0.15	60,000
Mines Co. of Am.	Mex.	0.02	40,000
Total			$205,230

U. S. Industrials.	Location.	Amt. per Share.	Amount Paid.
Cambria Steel	Penn.	$0.75	$675,000
Jeff. & Cl'f. C. & I., pfd.	Penn.	2.50	37,500
Phila. Gas, com.	Penn.	0.75	498,600
Total			$1,211,100

New Zealand Gold and Silver

Exports of gold and silver from New Zealand for the full year are reported by the Mines Department as follows:

	1907.	1908.	Changes
Gold, value	$9,867,118	$9,743,275	D. $123,843
Silver, ounces	1,562,603	1,731,336	I. 169,733

The gold bullion reported in 1908 was 506,381 oz. bullion, equivalent to 471,373 oz. fine gold.

West African Gold Mines

Gold production in West Africa—including the Gold Coast and Ashanti—in January was 24,844 oz. bullion in 1908, and 22,817 oz. in 1909; a decrease of 2024 oz. The bullion reported this year was equal to $442,804, or 21,810 oz. fine gold.

Colliery Notes

With reference to the observation of gas caps on safety lamps, the best authorities speak favorably of the use of a piece of blue glass in the foreground as a refinement that will enable the early detection of a blue gas cap on a small lighted oil wick.

Miners have a dislike for anything "new fangled," and consequently they view the advent of the rescue apparatus with feelings of distrust. When once they realize the true value of such apparatus, they will undoubtedly enter into the study of it whole-heartedly.

It is the habit of a gas to depart from the air currents and take up its abode in cavities along the airways. This is one reason why the reduction of pressure indicated by a fall in the barometer is dangerous; such an occurrence causes the pent-up gas in the cavities to expand in volume and mix with the air currents.

Henry Louis has called attention to the fact that our methods of testing for gas should be brought to a point of greater sensitiveness. The ability to see a cap is unequal among different men and consequently, the officials responsible for such testing should be required to undergo an examination. Colliery managers themselves may carry on such an examination by having a half dozen lamps burning in atmospheres of different kinds, and requiring the men to pass by one at a time and state what they can see. This test should be repeated at intervals, especially as the men grow older.

It is generally conceded that winding ropes constructed of steel wire are the best for colliery winding purposes. There is a divergence of opinion, however, as to whether the locked coil or the flattened strand ropes are best. Plough-steel locked coil ropes contain no hemp cores, consequently this class of rope is more rigid than the flattened strand variety. The latter class of rope possesses practically all the advantages of the former, and, furthermore, has no tendency to spin or kink. The flattened strand rope also exhibits less tendency to become brittle. Ropes of this construction are also easier to cap and to lubricate than locked coil ropes.

Warnings are of great benefit to colliery operators in enabling them to know when atmospheric conditions are dangerous. Henry Louis, before the Royal Commission on Mines in England, suggested that each colliery subscribe a small amount, say $2, to defray the expense of a center, from which warnings could be sent to adjacent collieries stating the likelihood of a great atmospheric depression approaching the district. The warnings should be sent as far in advance as possible, because the atmospheric conditions of mines differ so much. Many mines will indicate a change of the barometer before the barometer itself does, and others will answer much more slowly.

Basing his suggestion on the fact that a mixture of one-seventh of its volume of carbon dioxide to a mixture of firedamp at its most explosive point, will render the resulting atmosphere non-explosive, one mining engineer has proposed that a large furnace be erected near the mouth of each coal mine, and that sufficient carbon dioxide be generated to entirely fill the mine in a couple of hours, after which, all shots are to be fired. It is asserted by the same authority that this scheme will do away with the possibility of a dust explosion due to blow-out shots. The shots are to be fired by electricity, and after this has been accomplished, the fan is turned on full force so as to clear the mine of the gases that have been introduced. Mine operators will soon be dizzy trying to absorb the many ideas suggested to make their mines safe.

There is a certain amount of natural ventilation in all mines, and those with a temperature of more than 60 deg. at the working face probably contribute about 25 per cent. of the total volume of the ventilating current. It is always advisable to conduct the fresh air to the lowest point in the mine, and finish at the highest. Ascensional ventilation should be adopted so as to aid the fan wherever possible. One of the disadvantages of sprinkling in a mine is that the more vapor there is in the air the greater the strain on the work of the fan. Along this line it should be remembered that a waterfall in an upcast shaft greatly retards a ventilating current. Instances have been recorded where an accidental fall of water in an uncast shaft has been sufficiently detrimental to overcome the action of the fans and reverse the ventilation.

There has been much discussion of late as to the best standard of ventilation. The only practical method is to fix definitely the maximum percentage of marsh gas to be allowed in the return airway. Whenever the air contains a greater percentage of this gas than the amount prescribed, the ventilation should be considered foul. In dealing with ventilation in this way, the reason for fixing the standard, by prescribing a certain percentage of marsh gas, as the maximum permissible, is due to the fact that when a dangerous amount of carbon dioxide is present, the lamp would be extinguished before the gas would become dangerous to life. The greatest difficulty in fixing a certain standard of ventilation is the recognition that 1 per cent. of gas will create a condition of danger in a dusty mine, whereas 2 per cent. would not be any more dangerous in a mine free from dust. Any rules, therefore, will have to be modified in accordance with such conditions.

New devices and schemes for enabling the detection of small quantities of firedamp in a mine atmosphere, are being presented in rapid succession. One of the latest ideas advanced is to apply the microphone, by connecting this latter instrument in series with a telephone; when firedamp is present in the mine air, beats are sounded in the telephone located on the surface. The theory on which the scheme is based depends on the fact that if sound waves of two pipes of equal pitch impinge on microphones connected in series with a telephone, a clear note is heard, but if one of the pipes emits a slightly different note, there will be beats heard in the telephone. The practical arrangement is to have one pipe on the surface and the other underground; if firedamp is present in the mine, air of a different density will be blown into the underground pipe, which latter will emit a different note. The apparatus has already been tested in an atmosphere containing coal gas, and showed great sensitiveness. An admixture of but 0.1 per cent. firedamp gave three beats in twenty seconds, and an admixture of 1 per cent. gave 30 beats in twenty seconds.

Considerable care must be exercised when we attempt to dispose of gunpowder or dynamite. The *Engineer* suggests that the best way to destroy ordinary black gunpowder is to throw it into a stream under conditions that prevent any harm coming to human beings or animals through the dissolving of the saltpeter. If no suitable stream is available, the gunpowder may be poured out on the ground in a long thin line and ignited with a fuse at one end. To destroy dynamite cartridges, the paper wrappings should be carefully removed, the bare cartridges laid in a row with their ends in contact, and the first cartridge ignited with a fuse without a cap. Even with these precautions a simultaneous explosion of the entire mass may occur, so that it is wise to retire to a safe distance. The row of cartridges should be laid parallel with the wind and ignited at the leeward end, so that the flame will be driven away from the mass. Frozen dynamite should be handled with especial care, as its combustion is peculiarly liable to assume an explosive character. A small quantity of dynamite may be destroyed by throwing it, in very small bits, into an open fire, or the cartridges may be exploded one by one in the open air with fuses and caps. Dynamite should never be thrown into water, as the nitro-glycerine which it contains remains undissolved and capable of doing mischief. Other explosives which contain nitro-glycerine should be treated in the same way as dynamite. Ammonium nitrate explosives may be thrown in small fragments into an open fire, or, if they do not contain nitro-glycerine, may be destroyed by means of water. Explosive caps should be exploded singly with pieces of fuse.

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A Tariff on Zinc Ore?

Our advices from Washington indicate that the Ways and Means Committee is likely to recommend a tariff on zinc ore. It will be a very serious matter if such a tariff be established, and the committee should consider it carefully. In the first place let it discard the mass of memorials and statistics by which it has been overwhelmed from both sides. To a large extent they reflect only brief periods when commercial conditions, always fluctuating, were especially favorable to one side or the other, viz., miners or smelters. The matter of cost of production is so intricate that two experts of long experience in the business might discuss it for a month without coming to an agreement. A committee of laymen can expect no result other than confusion in dipping into the technics of such a business. Consequently it should confine itself to viewing the broad principles.

The average price for spelter at St. Louis during the last 10 years has been about 5.05c. per lb. Under existing conditions, aside from any tariff change, there is reason to anticipate a higher range in the years immediately to come, perhaps 5.25c. On the latter basis a price of $40 per ton for 60-per cent. ore at Joplin would leave but a narrow margin to the smelter. Yet, such a price for ore in the case of many operators at Joplin only meets the cost of production if all things be considered. Nevertheless, even so the mining of zinc ore is immensely profitable, inasmuch as the annual output of the Joplin district, about 250,000 tons, worth $10,000,000, pays a royalty of about $1,000,000 (in one form or another) to the owners of the land, who reap their profit while the operators may get none.

Now during the last decade there have been four years (of which three were successive) when spelter has averaged higher than 5.5c. per lb., and ore has fetched more than $40 per ton without leading to a material increase in the production of the Joplin district. The smelters have had to go elsewhere for the supply of raw material necessary to meet the requirements of domestic consumption, first to Colorado and then to Mexico. The ore resources of Leadville have waned as well as those of Joplin.

If a tariff be put upon zinc ore the price of spelter will be jacked up sufficiently to enable the smelters either to (*a*) obtain the necessary ore from Mexico and Canada at the increased cost, or (*b*) to obtain new supplies of ore from this country that normally cannot be produced profitably. There will be need for a careful adjustment of duties so as to keep out foreign spelter. If the latter be accomplished the only limit to the advance in price of spelter will be the point where consumption is restricted by users turning to cheaper substitutes.

Every cent that accrues to the pockets of the producers of zinc ore in the United States will come out of the pockets of American consumers. The smelters will pass on the advance to the galvanizers and brassmakers, and the latter to the users of the sheets and other manufactures This phase of the question is self-evident The miners want more money. Whence is it going to come? The middlemen—the smelters and the manufacturers of various degrees—may furnish it temporarily, but ultimately it must all be paid by the consumers.

Theoretically the smelter should not care what his ore costs (so long as he can sell the product at a proper profit), he being only a species of middleman. Practically he foresees that he will be driven among the rocks of shortage of ore supply, restricted consumption of spelter, and the competition of foreign smelters. These portend narrow profits, or none at all, and idle smelting capacity. All hope is to be abandoned of establishing an export trade in spelter or seeing the development of a smelting industry on the Atlantic coast Just as the tariff on lead ore drove a smelting industry to Mexico, so will a tariff on zinc ore divert foreign ores to Europe.

As to the competition of European smelters we may form some idea from the plans of the iron-bound convention recently formed by them. This intends to control the price for spelter at London to a range of £20@23, or 4.35@5c. With the present duty of 1½c. per lb. on spelter the corresponding prices at which it could be entered at New York would be 6@6.65c. Practically, the condition that is threatening in the United States would be enjoyable to the European convention which would use America as a dumping ground, whenever necessary, irrespective of the price of 6c., the very purpose of the convention being to take care of surplus production. The source of that surplus production is Broken Hill, New

South Wales, where the ore is produced under conditions as to labor, etc., as costly as anywhere in the United States. The rise of Broken Hill as a zinc-producing district is due entirely to the efforts of engineers in solving one of the most baffling problems that metallurgy has known. One of the greatest triumphs in that district is owed to an American engineer.

The cost and profit in producing zinc depend fundamentally upon the grade of the ore yielded by the mines. The miners of Joplin, having exhausted to a large extent their richer ore, are now mining a lower grade than anywhere else in the world and have been able to do so only by the exercise of extraordinary ingenuity, but they suffer from an outrageous royalty system that hangs on their neck like the Old Man of the Sea. The States of the Rocky mountains have ore that is richer but of less docile character and are subject to higher freight charges because of their remoteness. Nor can it be said that they have approached their problems with the same persistence, intelligence and energy as has been done at Broken Hill.

It is, therefore, the problem of the Ways and Means Committee, and after it of Congress, to balance on the one hand the needs and demands of the miners of the United States; and on the other hand the rights of consumers, also American citizens, and the evident danger to the domestic smelting industry.

The British Columbia Copper Company

The report of this company for the fiscal year ended Nov. 30, 1908, shows that during seven months the mines shipped 319,527 tons of ore. At the smeltery three blast furnaces in six months handled 321,427 tons of ore, which yielded 5,767,355 lb. of copper, 13,597 oz. of gold and 58,204 oz. of silver.

The cost per ton of ore handled, including all charges from ore in place to sale of the metal products was $2.63 per ton; the cost of producing, refining and marketing per pound of fine copper, after crediting expenditure with value of gold and silver realized, was 9.996 cents.

It seems to us that this cost of $2.63 per ton of ore is probably the lowest on record. It is the more remarkable in view of the high cost of coke at Greenwood. On the other hand, a favorable factor is the self-fluxing character of the ore, the latter constituting practically 100 per cent. of the furnace charge. But however the conditions are regarded, the result reflects very high credit upon J. E. McAllister, general manager of the company, and especially manifests his success in effecting a coördination of the work of the different departments in such a way as to secure maximum efficiency all around. It is certainly extraordinary that it has been possible to mine and smelt a ton of ore for $2.63, including freight on the metallic products to market, and refining and selling of the same.

The Osceola Report

The report of the Osceola Consolidated Mining Company for 1908 records once more the phenomenally low cost of milling achieved at its property. In the treatment of 1,426,329 tons of ore in 1908 the cost was only 15.8c. per ton, compared to 17.47c. in the previous year. We believe that these figures are unsurpassed anywhere. The betterment of conditions in 1908, with respect to material and labor, both as to the reduced wage for the latter and at the same time its increased efficiency, is reflected in the cost of mining and milling, which in 1908 was $1.50 per ton of ore against $1.84 in 1907. Consequently, although the yield of refined copper per ton of ore in 1908 was slightly less than in 1907, the cost per pound of refined copper was only 10.53c. against 12.44c.

We have frequently had occasion during the last 20 years to criticize unfavorably the policy of Mr. Bigelow, the retiring president, in some respects, although we have always commended the efficiency of his management with respect to mining and milling. We think that proper recognition should be accorded to the valedictory of the present management, given in its last official report as follows:

"As this is the last report which will be issued by the present management, they wish to place before the stockholders a judicial decision certifying as to their economical management of the property and as to the adequacy of the price realized through their selling agents for the product of the company. In the findings of fact by Judge Knappen, in his opinion dismissing the bill against the Calumet & Hecla Mining Company, the court says: 'It is only just to the complainant (Albert S. Bigelow) to say that the charges made against his management of the Osceola Consolidated Mining Company to the effect that its product has not been economically manufactured and sold, and that it has not been made to bring the best prices, are shown to be without foundation.'"

Proposed Coal Mine Legislation

The budding agitation for reform in coal mining is beginning to blossom in the introduction of radical bills in several State legislatures. It is to be hoped that all of the measures finally enacted into laws will at least be based on common sense, even though they are not formulated by persons having an understanding of the coal industry and its problems.

In one State, legislation has been proposed that will prohibit the sale of fuel in which there is any foreign substance. Should this become a law, gas companies would have to furnish gas free from any air, and coal producers would be held liable if any of their product contained bone or slate.

It might be well to punish the tradesman who puts sand in his sugar or water in his milk, if he be not sufficiently punished by the loss of discriminating customers; however, the dealer who can sell pure fuel as the merchant sells pure food is a wizard who has certainly secured advanced knowledge of the science of the next century. Thousands of dollars have been spent by coal operators in removing bony matter from their coal, and they have then had no little difficulty in finding purchasers for their purified product.

There is so much coal legislation that is necessary, that the passage of ill-advised laws is to be deprecated. There has lately been a general cry for the conservation of our fuel resources; however, we shall not conserve our coal deposits nor the lives of our miners by adding any unnecessary burden to the industry. Let us have action that will permit the coal operator to inaugurate sane improvements rather than the making of laws that will force him to rob his acres and kill his men in order that his business may survive.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Mexican Zinc Ore

At this time when zinc-ore prices are depressed and there seems to be so much confusion as to the cause, any scrap of real information bearing upon the question is doubtless welcome.

With a view to getting at the facts in regard to the relation of Mexican importations to the downward trend of prices, I wrote to an old friend, a prominent engineer who is manager of a Mexican mining company in Chihuahua, asking him about the zinc resources of the Republic and received the following reply which may be of interest to the readers of the JOURNAL:

"The zinc industry is not in as flourishing condition in Mexico as you seem to think. * * * I know little of the occurrence of zinc outside of this state, but I believe this is the principal zinc producing state in Mexico.

"Zinc ores are found in the following camps: (1) Picachos, on the Kansas City, Mexico & Orient railroad, about 125 miles from the city of Chihuahua, where carbonate ores are mainly produced; sulphides occur but not on a commercial scale. (2) Santa Eulalia, about 16 miles from the city of Chihuahua, produces carbonate ore exclusively. (3) San Isidro, on the Chihuahua & Pacific railroad, about 140 miles from the city of Chihuahua, where sulphides alone are produced. At San Isidro the Sutton-Steele process of dry concentration is used with excellent results. (4) Almaloya, where carbonate and silicate ores are produced. (5) Parral and Santa Barbara produce sulphide ores only.

"The zinc orebodies are always found associated with silver-lead and in many cases the zinc is simply a by-product; although some mines, as at Picachos, are mined solely for zinc. It is claimed that there are, more or less exposed, in the state, 1,000,000 tons of ore, viz., Picachos, 50,000 tons; Santa Eulalia, 100,000; San Isidro, 200,000; Almoloya, 50,000; Parral and Santa Barbara, 600,000.

"The carbonate and silicate ores run from 32 to 45 per cent. zinc after being hand sorted. Crude sulphide ores run from 10 to 35 per cent. zinc. The sulphide ores present hard and complex milling difficulties. Formerly zinc was considered a detriment in the ore and such ores sold to the smelters were given a low zinc limit and charged for over about 5 per cent., losing thus the zinc and being penalized for its presence.

"The foregoing camps are producing almost all the ore that comes from this state, which for September and October was about 125 tons a day. Picacho ships carbonates, lead-free 45 per cent. zinc; San Isidro, sulphide concentrate, 45 per cent. zinc; Santa Eulalia, carbonate, lead-free, 35 per cent. zinc."

I simply give the foregoing as a statement of fact from which the reader can draw his own conclusions.

FRANK NICHOLSON.

Hazel Green, Wis., Feb. 16, 1909.

Assay of Gold in Copper Bullion

I was much interested in Doctor Hunt's description of the assay for gold in copper bullion by the sulphuric-acid method. I have been using this method for about two years, and have found the results to be very reliable as compared with those obtained by the "all-fire" method. In fact, it is my experience that the results are slightly in favor of the sulphuric-acid method.

However, I cannot agree with him as to the necessity for the use of cupric sulphate. It has been my method to use a solution of mercury nitrate or sulphate equivalent to 100 mg. of mercury, adding it directly to the copper borings, usually agitating it a little. Then add 80 c.c. of concentrated sulphuric acid, and place on a hot plate, boiling for three-quarters of an hour. Now cool and add about 400 c.c. of hot water, stirring it in gradually when all of the crystals will dissolve. Boil for 15 minutes; let settle and filter through a triple filter.

It has been my contention for some time past that the reason why the ordinary wet method gives low results is not because the gold goes into solution, but because of its very finely divided condition due to the violent reaction of the nitric acid, and that it is then carried through mechanically by the solution.

As a part proof of this theory, I have found that I can get results which compare favorably with the fire assay if I use a mercury salt. However, the results are not so uniform as in the case of the sulphuric-acid method.

The author of the mercury method always claimed that any sulphur present in the bullion will form a sulphide of mercury, and that this will take the place of lead acetate. It is also my experience that in low-grade bullion running from 10 to 50 oz., the silver is thrown down with the gold, and I could find no trace in the filtrate. Of course there may be some bullions that may require some modification, but I have not come across them.

It would interest me and perhaps others if Doctor Hunt would explain his theory for the use of permanganate in the filtrate before precipitating the silver. I have found no difficulty in getting all of the silver down by simply adding salt solution to the filtrate without any preliminary treatment, of course, taking the precaution to add enough to throw down any mercury that may have been dissolved. My work has included material running from 10 to 600 oz. in silver.

It is not my intention to criticize Doctor Hunt. I am rather in hopes of hearing from others, as the all-fire method is expensive and takes such a long time, and a method such as the sulphuric-acid method seems to me would be a blessing to the assayer.

F. B. FLINN.

Newark, N. J., March 2, 1909.

The Value of Good Management

One of the first questions asked of a promoter by a capitalist, or successful investor, after having satisfied himself regarding the merits of an industrial proposition, is "Who is going to manage this business?" The successful mining investor also asks the same question, and if everyone made sure of this important point before putting his money into a mining enterprise, there would be fewer failures than occur at present in what appeared to be "sure things."

It is surprising what chances people will take in mining investments without asking who is going to manage the property after it is bought, so that it can actually be made to pay the returns figured out on paper. More often than not, the engineer who has examined the property for purchase, if any engineer is employed at all, is not retained to carry out his own plans and recommendations, and the man who is placed in charge—usually some friend or relative of the buyers—carries out his own ideas, regardless of the engineer's previous advice, and so the entire enterprise often fails. The engineer's reputation generally suffers in the process also, although it may be no fault of his, as people are apt hastily to judge these failures from the results alone. There is an old saying that figures can-

not lie, but they are apt to be most misleading unless you know who made them, and who is going to make them work out in practice. No really successful mining man would think of investing his money in a proposition in regard to the management of which he knows nothing, no matter how well it shows up, unless he simply intends to hold it, as a piece of real estate, for a natural rise in value. Men with promising properties are constantly asking engineers to interest investors in their properties, without explaining at all who will manage them, but no engineer feels justified in complying with such a request.

This subject has been so impressed upon my attention lately in several instances, that I should like to set forth my views upon it. I am inclined to place a value of about 75 per cent. upon the management of a new mining proposition, and something like 25 per cent. upon the merits of the property itself. Of course, there are exceptions to this rule, as to most rules, notably in the case of a very rich property which pays a good return in spite of the management—where the mine is said to have made the reputation of the man without just cause—but even then a man having better executive ability and who knew his business thoroughly would undoubtedly have produced better results. In my experience such men are most difficult to find, and are worth all the money you pay them. Generally, I think it is the custom to give the manager, besides his salary, an interest in the property as an incentive to do his best. I also believe it is very rare nowadays that such a man attempts to temporarily impair the value of a property for stock-gambling purposes. The manager's chief desire is to build the property up and make it more valuable all the time.

In speaking of the management of a property, I have two positions particularly in mind. It does not always follow that a capable superintendent, who is competent to handle the miners and other men about the mine and to get the best work out them, is also equally able to pass upon the merits of a mining property or to plan out the proper work to be done. I believe these various vocations are special gifts from nature, and am backed up in my theory by knowing most excellent mine managers who have recommended very poor propositions to purchasers, honestly believing them good investments. It also follows that a good assayer or mill engineer, is not always equally as good in sizing up a mine. We are all specialists nowadays in our own field of work, and the results obtained from a harmonious combination of these different men is far ahead of what it used to be with only a general "handy man about the place." If, however, the examining engineer has executive ability, a loyal and efficient superintendent or mine manager to carry out his ideas, and the responsibility for the success of the mine placed upon his shoulders, then the owners have the best chance of winning out, and the men in charge deserve all the benefits they may get.

Not very long ago, a mine owner used the argument to me that his mine ought to be a good one because he had spent over $200,000 on it. However, in spite of this fact it was not. Another gentleman, who owned many large interests, all of which were uniformly successful, had invested heavily in a property years ago. It was a failure from the start, but still he had never been to see it himself, nor would he send an engineer to examine it and pass upon its value. Consequently, the mine has been shut down for years, and he keeps paying the taxes out of his pocket. These two cases were cited by the owners as results of bad management. In reality, they were not only results of bad management, but were primarily due to the lack of an examination by a competent engineer in the beginning. A poor mining property cannot be made to pay with the best management in the world, but a good one will pay in direct proportion to the management, and the better the management is the more confidence people will have in investing their money in it.

I am strongly in favor of placing a property in the hands of the engineer who examines it for the purchasers and of holding him responsible for the success of the investment. By this, I do not necessarily mean that he should live upon the ground, but rather that he should be retained as a consulting engineer, with his own superintendent or manager in charge, and should visit the mine occasionally to see that his plans are carried out. He should be given some interest in the property and should keep constantly in touch with the work as it progresses, making reports to the directors and fulfilling all the other functions of his position. The more properties this engineer can secure to handle in this way, the more valuable he becomes, as his experience in one place will help, not only him, but also the owners of the next mine.

A. P. ROGERS.

New York, Jan. 28, 1909.

The Steelton, Penn., *Reporter* says that a steel rail rolled by the Pennsylvania Steel Company, in 1876, for the Cumberland Valley Railroad was discovered the other day by James P. Gaffney, who was inspecting a lot of old rails sold by the railroad to a southern lumber company. The rail had been in use on the main line for 32 years and is still in serviceable condition. The date of manufacture is plainly stamped on the rail.

A Benefit Fund for Coal Miners Families

In view of the frequency of recurring accidents in the coal mines of this country and the recent movement to collect subscriptions for the benefit of those widowed and orphaned by certain of the more serious disasters, is not the time propitious for starting a "National Fund" to which every coal operator in this country—from Pennsylvania to the Pacific coast—should contribute monthly, or annually, a fixed sum per ton of product?

One mill per ton would seem to be within the means of the smallest operation. But such a fund, vested in and administered by a trust composed of three men of national reputation—appointed by the President of the United States—with the governors of the coal-producing States as an advisory commission would meet all requirements.

It would even seem that such a fund might be utilized to carry out important investigations looking to the development of safety appliances and improved methods on broader lines than those now being pursued by the Government.

In Pennsylvania a bill to tax coal operators with similar objects in view has been voted down on the theory that such a tax would ultimately fall upon the consumer; surely, a general contribution of 1 mill per ton would not be worth considering in such connection.

I hope that this idea may appeal to the readers of the JOURNAL sufficiently to excite discussion. If practical, it has great merit over any system of taxation. Is it practical? OPERATOR.

New York, Feb. 20, 1909.

The European Zinc Convention

The organization of this convention comprises three groups of smelters, viz., (*a*) the German, including the Dutch and some of the French and Belgian producers; (*b*) the Franco-Belgian; and (*c*) the British. Among the important producers only Giesche's Erben remains outside, that famous concern adhering to its historic policy of independence. The German groups have incorporated as the "Zinkhüttenverhand," with a capital of 2,047,000 marks, of which Fritz Lob is chairman. Mr. Lob is director-general of the Hohenlohe interests; the organization of the convention is largely due to him. The spelter of the German group is to be sold by the Metallgesellschaft, Frankfurt am Main; Beer, Sondheimer & Co., of Frankfurt am Main; and Aron Hirsch & Sohn, of Halberstadt. These concerns themselves have large zinc-smelting interests. Production of all the groups will be regulated according to the plan that we have previously stated.

The Canadian Mining Institute

SPECIAL CORRESPONDENCE

The annual meeting of the Canadian Mining Institute opened in the Windsor Hotel, Montreal, Wendesday morning, March 3. At the opening session President W. G. Miller delivered a brief annual address. The institute, he said, was formed in 1898. It numbered then 63 members. Today there were 850. During the last ten years the institute had rendered valuable service to the mining industry in Canada. Several excursions had been organized by it, with the result that the mineral resources of Canada had been brought to the better acquaintance of mining engineers. Among the excursions organized, Mr. Miller mentioned that to British Columbia in 1899, that to the provinces of Quebec and Nova Scotia in 1900, which was organized with the American Institute of Mining Engineers, that to Cobalt in 1907, and finally the excursion of last year, which permitted the mining engineers to visit the mining lands of Canada from the Atlantic to the Pacific.

J. McLeish, of the Department of Mines, Ottawa, presented a report on the mineral production of Canada, a summary of which is given on another page. The reports of the officers and council were presented and approved, and other necessary business transacted.

The president's gold medal for the best student's paper presented at the last annual meeting, was awarded to H. H. Yuill, of McGill University.

J. Obalski, superintendent of mines for Quebec, presented a report in which he said the total mineral output for the province for 1908, valued at the mines, or at the nearest point of shipping, was $5,493,664. The mining industries employed 6324 men, whose wages for the year amounted to $2,094,357. The biggest item of production was asbestos, the output being valued at $2,551,596. Cement came next with $1,127,335.

TAXATION OF MINING LANDS

This subject was brought up at the afternoon session by a paper presented by E. L. Fraleck, of Cobalt. He pointed out the anomalies that existed, by which holders of land in unorganized parts were taxed, while land in organized regions escaped. He was strongly in favor of the 2c. tax, and thought there were even reasons for a higher tax, say of 5 or 25c. per acre. He spoke of the thousands of acres where the mineral rights had been bought by speculators, while the farmer who owned the land paid the taxes. In eastern Ontario there were places, owing to this anomaly, where it was practically impossible to obtain a title. The owners of the mining rights had disappeared. He said that the value of the minerals on the property was evidently the only consideration actuating the owner, and if the owner desired to hold that land idle, he certainly should have no objection, for the privilege of doing so, to paying the people of the country five cents an acre, especially when the public was spending a considerable amount of money each year in assisting him to put his rights to a profitable account.

R. W. Brock, director of the Geological Survey, declared that the greatest bar to development was idle lands, tied up through being held by speculators and the title obscured. He deprecated the frequent practice of the past, by which mineral rights had been given away with the surface rights.

The subject was discussed by a number of speakers, Colonel Hay, of Toronto, advocating the appointment of a commission to secure uniform tax laws.

THE ELECTRIC FURNACE

The evening session was held at McGill University, and was devoted to an illustrated lecture by Professor Stansfield on "The Electric Furnace, with special reference to the Electric Metallurgy of Steel." By the aid of limelight illustrations, the various types of furnace were depicted, and interest centered strongly in the experiments in the melting of metal, etc.

At the close of the lecture a visit was paid to the basement rooms, where electric furnaces were shown in actual operation.

THE STUDY OF ORE DEPOSITS

At the morning session on Thursday, March 4, S. F. Emmons, United States Geological Survey, sketched the history and development of the present knowledge regarding ore deposits. He traced this from his experience of 40 years in the United States, and showed the present strong tendency to find that orebodies are principally connected with igneous and volcanic activity. Mr. Emmons laid particular stress on the benefits to the mining industry in the United States which had been derived from the careful study of its mineral deposits by the geological survey.

Waldemar Lindgren, United States Geological Survey, Washington, reviewed the distribution of mineral deposits in the United States and showed that rocks of different ages were characterized by minerals of distinctly different character. He distinguished these periods, marked by predominance of certain metals, as metallogenetic epochs.

Dr. A. C. Lane, State geologist of Michigan, gave an address on "Mine Waters of Michigan," presenting the results of an analysis of the waters and the deductions to be drawn of the nature and origin of the iron and copper ores. He also discussed the influence of the grain of rock and its value in determining the presence of copper and other ores.

EXECUTIVE SESSION

The afternoon session was an executive session, devoted to the consideration of proposed amendments to the by-laws. These were thoroughly discussed, and most of them adopted.

After the session a party of the members under the guidance of Prof. F. D. Adams, visited the buildings, museums and laboratories of the various departments of engineering at McGill University. The completed new building was pronounced by the visitors to be the finest of its class in America.

In the evening there was a "smoker" largely attended by the members and much enjoyed.

ASBESTOS AND CHROME ORE

The morning session on Friday, March 5, was largely taken up by an elaborate paper by John A. Dresser, mining geologist, of McGill University, on "Mineral Deposits of the Serpentine Belt of Southern Quebec," chiefly asbestos and chrome ore. Other minerals dealt with were talc, copper, antimony and nickel. He closed by laying stress on the view that the serpentine belt was not merely of present importance, but of still greater prospective value.

THE CLOSING SESSION

At the afternoon session a number of papers were read, among them "Notes on the Chibogomou Region of Quebec," by Prof. E. Delieux, of Laval University, Quebec; "Timber Resources in Mining Districts," by Dr. B. E. Fernow, Toronto University; "The Effect of Fungi on Mine Timbers," by James M. Macoun, Geological Survey, Ottawa; and "Notes on the Occurrence of the Orebody at the City of Cobalt Mine," by Dr. Frank D. Adams, of McGill. Other speakers were Dr. J. F. Kemp, of Columbia University, New York; and Fritz Cirkel, of Montreal, who read a paper on "The Depth of Asbestos Deposits."

The remaining business and the committee reports were then disposed of. At the close of the meeting President W. G. Miller, of Toronto, who presided, congratulated the mining institute on the large attendance, and the enthusiasm which the convention had evoked.

The meeting was closed by the annual dinner in the evening, which was largely attended. Among the speakers besides President W. G. Miller were the Governor-General of Canada; Hon. Mr. Templeman, Dominion minister of mines; Hon. Frank Cochrane, minister of mines of Ontario; J. Obalski, superintendent of mines of Quebec; G. S. Lindsay and Mr. Goodeve, of British Columbia; Dr. James F. Kemp, of New York; J. E. Hardman, of Montreal; George R. Smith, of Thetford Mines, Quebec, and others.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Dr. R. A. F. Penrose, Jr., has returned from Europe.

S. E. Bretherton has moved his office to 311 Mills building, San Francisco.

William H. Cook has moved his office from Tucson, Ariz., to El Paso, Texas.

E. S. Moulton, of Central City, Colo., is making a business visit to Eastern cities.

Leonard Loehr, manager of the King Solomon mine, Sylvanite, N. M., is in New York.

L. H. Jones, of Asheville, N. C., has been appointed receiver of the Franklin Kaolin Company.

Jules H. Hirt is now in charge of the Dos Cabezos mines, near Casas Grandes, Chihuahua, Mexico.

The office of Charles L. Denison, with the Buffalo Mines, Ltd., and the Morris Run Mines, is now at 165 Broadway, New York.

Robert Huntley is now president of the Bonanza Belt Copper Company, of Johnson, Ariz., in place of R. Allyn Lewis, resigned.

H. C. Vancil, formerly of Joplin, Mo., has taken charge of the Joplin Mining, Milling and Tunnel Company at Georgetown, Colorado.

E. E. Carter has been inspecting the Payette dam in Boise county, Idaho, with the view of installing power for the Gold Hill mine at Quartzburg.

David L. Gregg, long manager at El Paso, Tex., for the Mine and Smelter Supply Company, of Denver, has resigned and removed to California.

Stanley C. Sears has been appointed general superintendent of the Benito Juarez Mines Company, with office at Salinas, San Luis Potosi, Mexico.

Harrison S. Morris has been chosen president of the Wharton Steel Company, in place of the late Joseph Wharton. Mr. Morris has been treasurer of the company.

George A. Packard has returned to Wakefield, Mass., from a three-months' trip, in which he visited parts of Montana, California, Nevada, Texas and Mexico.

Herbert C. Hoover, who has been delivering a course of lectures at Columbia, sailed for London on March 10. He expects to visit this country again about the end of the year.

Dr. J. E. Woodman, professor of Geology at Dalhousie University, Halifax, N. S., has been appointed professor of geology and curator of the geological museum at New York University.

Claude T. Rice, recently on the staff of the JOURNAL, has accepted a position at the Marmata mine on the Cauca river in Colombia. He sailed from New York March 6, on his way to South America.

Dr. Franz Meyer has resigned as director and treasurer of the Metallurgical Company of America and has returned to Germany to enter as partner in the firm of R. Wedekind & Co., at Uerdingen (Lower Rhine).

Millard Woodsome, treasurer of the Hoff Electrostatic Separator Company, is in Platteville, Wis., superintending some tests. He will return to Denver, Colo., shortly, where he will make his headquarters for some time.

Seward Babbitt, secretary and general manager of the Lash Steel Process Company and the Canadian Lash Steel Process Company, Ltd., has resigned his position with these companies and has returned to the International Steam Pump Company.

Henry M. Adkinson has undertaken the management of the Morning Star Mining Company for Boston clients who are operating near Ophir, Colo. Mr. Adkinson will continue as manager of the Gold Pioneer Mining Company at Telluride, Colorado.

Dr. Frank D. Adams, dean of the faculty of applied science of McGill University, Montreal, and Dr. Willet G. Miller, provincial geologist of Ontario, have been appointed honorary life members of the Institute of Mining and Metallurgy of Great Britain. Dr. J. B. Porter, of McGill University, and J. B. Tyrrell, of Toronto, have been elected to the council of the Institute.

William Morris Davis, professor of geology at Harvard University, who has been lecturing at the University of Berlin as exchange professor, is about to put in practice a plan unique in Germany. Accompanied by 60 of his geological students, he will make a tour through Sondershausen, the Wera Valley, Göttingen, and the Leine Valley for the purpose of giving practical illustration to the subject of his lectures.

Frederick H. Morley has returned to Denver from Mexico, where he was during the past two months. As field engineer for the Potter Palmer estate of Chicago, he was engaged during January on the examination of the Promontorio mine at Cusihuiriachic, Chihuahua, which was taken over by the Palmer estate on Jan. 15. During the remainder of his stay he investigated mining properties in the States of Jalisco and Oaxaca for the Chicago Exploration Company.

H. S. Snyder, recently vice-president, has been elected president of the Juragua Iron Company, with office at South Bethlehem, Penn. DeBerniere Whitaker, recently general superintendent of the company, has been elected vice-president and general manager, with headquarters at Santiago de Cuba. E. M. Holmes, recently assistant superintendent of the Spanish American Iron Company at Daiquiri, Cuba, has been appointed general superintendent of the Juragua Iron Company at Firmeza, Cuba.

Obituary

Dr. Gardner C. Wood, who died at Somers, Conn., March 7, aged 86 years, was for many years a student of geology, especially of the geology of the State. Some years ago he received considerable attention in connection with an alleged discovery of gold near his native place.

Societies and Technical Schools

Western Association of Technical Chemists and Metallurgists—The Chihuahua branch was organized at a meeting held Feb. 12. The following officers were chosen: Chairman, D. W. Shanks, La Plata mine; secretary, Leonard Worcester, Jr.; treasurer, George Griggs; member of board of control, J. H. Baron, Mexican Chemical Company.

Illinois Fuel Conference—A conference was to be held at the University of Illinois, at Urbana, Ill., March 11, 12 and 13, under direction of the United States Geological Survey, Technologic Branch; the Illinois Geological Survey and the College of Engineering of the University. The subjects to be considered included "Mine Explosions and Their Causes;" "Rescue Stations;" "Explosives;" "Coal Analysis;" "Smoke Suppression," and "Economy in the Use of Fuel." Examination of the fuel laboratories of the university, and of the mine explosion and rescue station recently established there were also on the program.

Mining Society of Nova Scotia—The seventeenth annual meeting was held at Halifax, March 3 and 4. The opening session was devoted to the president's address and the transaction of necessary business. Later Professor J. E. Woodman delivered an address on "Iron Mining in Nova Scotia," and a number of papers were read and discussed, among which were the following:

F. P. Ronnan—"A Practical Suggestion for Testing the Gold Mines of Nova Scotia."

E. Percy Brown—"How Can the Gold Mining Industry of Nova Scotia be Assisted.'"

E. Percy Brown—"Conservation of Our Forests in Relation to Gold Mining."

C. V. Brennen—"Some Mining Condidions in Nova Scotia."

H. B. Pickings—"Gold Production in Nova Scotia from 1889 to 1908, inclusive."

H. E. Coll—"Shaft Collar at No. 1 Allan Shaft."

John Johnston—"Submarine Coal Mining."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Salt Lake City, Denver, Toronto and Indianapolis

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 6—The farmers in certain townships of Yuba county are protesting against the Government settling basin for débris established on the Yuba river south of the dredge at Hammonton. In the control of the river the engineers of the Federal Government decided on the construction of a series of restraining basins for the retention of coarser débris, the building of a series of training walls and a diversion canal connecting with a settling basin for the impounding of sand carried in suspension by the waters of the river. The protesting farmers assert that there is danger in the construction of such dams and basins because in flood seasons like the present, a mass of water may be suddenly released and overflow their properties. The settling basin is being built by the dredgers. These same people also protested against the proposition of the county supervisors to increase the number of pounds allowed to be hauled over the roads during the rainy seasons. At present the amount allowed is 3500 lb. and only last week a dozen teamsters were fined $50 each for hauling loads on county roads exceeding this amount. The Marysville merchants want the present ordinance changed in the interest of the dredge mining people because they have large quantities of heavy freight delivered from Marysville to Hammonton where the large dredges are in operation. Some of the pieces of machinery manufactured in the new shops at Marysville, and intended for the dredges at Hammonton weigh thousands of pounds and must be hauled intact by large teams. It was asserted that the poor roads prevailing dated from the advent of the dredge interests in the county. The community in that section has not prepared itself for the beginning of large enterprises such as the manufacture and operation of dredges. For many years, since the virtual prohibition of hydraulic mining, most of the people have been engaged in farming pursuits. Now come the dredging interests with a large manufacturing establishment at Marysville and numerous dredges at Hammonton. The old-fashioned ideas of hauling loads of hay, etc., over the roads must in time give way to more modern methods where it is necessary to provide roads capable of standing the weights of heavy machinery. To all this the farmers protest but the dredge men have decided to force the issue since they cannot work satisfactorily under present conditions. The roads must be rebuilt to suit present circumstances or these large enterprises will be greatly hampered.

The new rock-crushing plant of the Natomas Consolidated at Fair Oaks in the Folsom dredging field, now in course of construction will cost $150,000 and produce 1500 tons of crushed rock every 10 hours. The rock will be crushed to seven sizes, including small gravel for roofing purposes. This new plant, together with the old one already in operation at Dredge, in the same field, will enable the company to ship 65 cars of rock every working day. Storage capacity is arranged for 125,000 tons so that after each winter large quantities of rock will be available for road work. All this rock comes from the cobbles dug out in dredge operations on the auriferous gravel. Good macadam is also being made from cobbles dug up by the dredges at Oroville in Butte county. This by-product of gold dredging is one of the things not at first thought of in connection with this industry.

The mine owners of the State are much interested in a bill which makes any person who purchases gold bars, bullion, gold quartz, or gold bullion or mineral containing gold, keep a register of the transaction with the name and residence of the pledger or seller. He must also produce for inspection this register to any officer holding a warrant authorizing him to search for personal property, or on the order of a committing magistrate directing such office to inspect said register, or account of sales or purchases. This is in the interest of mine owners who are losing money through "high-grading."

No less a person than the secretary of the Associated Oil Company, the largest State organization engaged in the production of petroleum, is of the opinion that there is now an overproduction of oil in California. He thinks that the overproduction will be between 6,000,000 to 9,000,000 bbl. per year. While there were 47,500,000 bbl. of oil produced in California in 1908, 53,000,000 to 56,000,000 bbl. will be produced this year. In January, 1909, the production was 146,000 bbl. daily against 142,000 in January, 1908. At present there are 450 strings of tools running in the State producing 900 wells annually, which wells are naturally yielding much oil. The first of this year the Associated Oil Company issued a general order to cut down on its development work for the present. The home consumption of oil is increasing, but oil men must look to the Far East to help use up the vast amount now being produced in California. Japan is expected to be the principal foreign consumer.

Within a day of the time that the holders of the bond on the Oustomah gold mine at Nevada City intended to throw up the bond and quit, a clean-up at the mill proved that the ore was much richer than was expected, and 24 hours more time was asked for to make payment.

Salt Lake City

March 5—The International Smelting and Refining Company has three miles of grading completed and ties laid. The rails have arrived and the entire line will be finished by May 1. The railroads announce a reduction of $1 per ton on ores ranging between $20 and $60, and 50c. per ton on ores ranging between $70 and $100 from southern Nevada camps to the Salt Lake valley smelters. This reduction commences on April 3, and will particularly affect Goldfield and Tonopah.

Nearly 100 stocks are now listed on the exchange and most of them are active. The recent strike of the Iron Blossom was responsible for heavy trading in Tintic stocks. The Iron Blossom has begun the stoping of ore, and 100 tons of high-grade ore will be shipped to the Knight smelter daily.

The following properties, all of which are situated at American Fork and are controlled by Jesse Knight, have been listed upon the local exchange. Each company has a capital of 1,000,000 shares of 10c. par value. The ores carry lead, silver, gold and copper. The Mineral Flat, comprising 25 claims; the Miller Hill, 23 claims; and the Major Evans Con., 31 claims. There are now 17 Knight companies listed upon the Salt Lake exchange.

The Grasselli zinc plant at Park City is now treating 65 tons of zinc middlings per day. At the annual meeting of the Bullion-Beck Company, held March 1, the following officers were elected: George W. Heintz, president; J. F. Smith, vice-president and treasurer; P. F. Farnsworth, J. A. Cunningham, C. E. Allen, J. Fewson Smith, Jr., and Frederick Lyon, directors. This property is now controlled by the U. S. Smelting and Refining Company.

The Cactus mill at Newhouse was closed March 1. It had been the intention to keep one-half of the mill running while the other half was being remodeled, but on account of the low price of copper it was deemed best to suspend operations entirely

while the mill is being remodeled. This work should be completed about the middle of April.

Butte

March 4—The affairs of the North Butte Extension Development Company, successor to the North Butte Extension Mining Company, are still far from settled. J. A. Ryan, superintendent, has recently resigned as a result of orders from the East to suspend all operations. A. M. Andrews and R. J. Horner, of the board of directors, have also resigned, and there is still considerable dissension among the stockholders as to the details of the reorganization plan. It was the intention of the management to commence operations within a short time, and the surface plant was put in readiness for this purpose, but the difficulties encountered within the past few weeks have delayed resumption of work. It is stated that trouble has been experienced in getting the stockholders of the old company to pay the assessment necessary to exchange the old stock for the new, and that until there is a more generous response to the company's offer of exchange there will be no further work done on the properties.

The Government assay office at Helena has made public its report for the month of February showing that the amount of bullion received exceeded that received in February, 1908, by $32,821. The contributions from the several counties are as follows: Broadwater, $2569; Chouteau, $37,296; Deer Lodge, $3807; Fergus, $57,996; Granite, $194; Jefferson, $73; Lewis & Clark, $9160; Madison, $28,849; Missoula, $400; Silver Bow, $772.

Denver

March 6—At Leadville the Western Mining Company, working the Wolftone mine, which has one of the deepest shafts in the northern part of Carbonate hill, has secured the adjacent territory extending as far north as Big Evans gulch. This territory is now to be developed by a tunnel driven from some point near the bottom of the Wolftone shaft, which will pass from 300 to 500 ft. under the old workings in Small Hopes, Robert E. Lee, Tip Top and other bonanza mines. The purpose of the work is to develop the lower ore horizon of that section.

In the Cripple Creek district, the output for the past month was diminished by the bad weather. Operations at Stratton's Independence were retarded by the same causes, but now that spring has arrived, the mill has gone to work on the dump ores.

The Gilpin county camps of Central City and Black Hawk have not been materially affected by the severe weather. The Newhouse tunnel is being driven ahead with a small force, with no new developments of note to record as yet.

The high mines of the San Juan region are still in the grasp of winter, and in fact mining operations all over the State are quiescent from similar reasons.

Goldfield, Nevada

March 2—Production of the Goldfield mines for the week ending Feb. 27 was 6595 tons valued at $259,600. This does not include ore shipped to the Western Ore Purchasing Company.

The Nye and Ormsby county banks located at Reno, Carson City, Tonopah, Manhattan and Wonder closed their doors Feb. 23 and have gone into liquidation. The banks are entirely solvent and this action is due to the stringency of the money market, it being impossible to secure the necessary coin without sacrificing securities. The assests aggregate $1,600,000 with only $300,000 due its depositors, which insures every depositor being paid in full and that the stockholders will receive par for their stock, with a surplus left over.

In a decision rendered March 1 by the Supreme Court of Nevada, Thomas B. Rickey wins in the habeas corpus proceedings and all indictments against him and the bank directors fail. The court holds that under the State banking laws the receipt of funds by the teller could not be a receipt by the president unless an agency existed between them so the president could be regarded as principal. As an appeal to the U. S. Supreme Court is unlikely to be made, this means that Rickey and associates will go free after wrecking hundreds of homes in this State by their unsound financial exploitations.

At the Directors' meeting of the Florence Goldfield Mining Company held in Goldfield March 1 the entire board of directors was re-elected. It was decided not to pay a dividend at this time. This decision is explained by the fact that most of the leases heretofore existant, have expired and with them a large source of revenue has been cut off. No specified time is set for the resumption of dividends but they will be declared as soon as financial conditions warrant it.

Indianapolis

March 8—The order appointing William C. Niblack, of Chicago, receiver for the Deering Coal Company was brought to this city during the past week for entry in the United States Court. The managers of the company mines in Indiana say it has been evident for some time that big customers of the Deering mines were going elsewhere. The Illinois Steel Company transferred contracts for several thousand tons daily to other Indiana companies, notably the Vandalia Coal Company. Some of the orders went to companies in the Clinton field. Coincident with these transfers has been great activity in securing coal-land options in the Clinton field and also in the Vigo county field, which, too, is coincident with the recent incorporation of a company to build a short line from that particular field into Illinois by which coal may find outlet to the big steel plants on the lake near Chicago.

The Deering company was one of the first Western coal-mining companies to form a big merger and placed over 30 mines in this State under one management. The company owns about 17,000 acres of coal land in Indiana, and an effort will be made to keep the mines running under the supervision of a receiver to be named in Indiana. The March pay-roll will amount to $150,000. The Deering company was incorporated under the laws of Delaware in 1904. Its general offices are at 84 Van Buren street, Chicago. R. R. Hammond is president and J. B. Boynon secretary.

The Indiana Legislature adjourned March 8 after a 60-days' session. A number of bills affecting mines and miners were introduced, but only a few were enacted into law. The Foor bill providing for weekly payment of wages to coal miners, and the Higgins bill, making it lawful to use mine drills 3¼ in. in diameter and requiring the operators to sharpen them. were passed.

An appropriation of $7500 was made for the expense of the State Mine Inspection Department, and $8420 for the Department of Geology. Special efforts are to be made for the betterment of mining conditions and for the completion of coal-land surveys during the next two years.

Toronto

March 6—An order in council just adopted by the Canadian government extends the regulations for the disposal of quartz mining claims to lands within the limits of reserves established under the Dominion Forest Reserves act subject to the following restrictions: A crown grant will not be issued but the holder of a claim may obtain a 21-years' lease; no trees are to be cut without the permission of the Superintendent of Forestry; the lessee must keep clear of all inflammable material a space of at least 100 ft. from his works; engines must be fitted with spark arresters. The regulations in regard to coal-mining rights in the Northwest have been changed. Heretofore such rights could only be obtained by lease, the lessee paying in advance $1 per acre yearly. By the new regulation an applicant may obtain a two-years' lease of 2500 acres on payment of $100. This is designed to encourage prospecting for coal where no known surface indications exist. The money will be returned upon proof of actual prospecting work having been done, or will be applied on rental in case of subsequent lease.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Swisshelm—Prospecting is being carried on in the Swisshelm mountains across the Sulphur Springs valley from the new camp of Courtland. The Swisshelm Development Company and the Heffern Mining Company are each sinking shafts. Gold-copper ores have been found in the shafts of both companies.

GRAHAM COUNTY

Shannon Copper Company—Plans are being made to increase the output to about 2,000,000 lb. a month in order to reduce the cost of production.

GILA COUNTY

New York-Arizona Gold and Copper Company—Development work on the Louise claim has been rewarded by the disclosure of an 8-in. vein of gold-copper-silver ore at the 80-ft. level. A 15-h.p. gasolene hoist has been installed at the shaft, but work has been discontinued on account of water. Close to this shaft, the Thompson tunnel, which has been driven about 400 ft., opens up a 4-ft. vein of gold-bearing rock.

NAVAJO COUNTY

Silver Creek—A new company has been organized under the name of the Portal Mining Company to operate the Duffner property.

California

AMADOR COUNTY

Defender—Owing to the difficulty of obtaining fuel, this company has shut down for the present.

Zeila—Underground men have been laid off because of the immense flow of water at present.

BUTTE COUNTY

Wyandotte—The mill has been rebuilt, equipped with a new power plant and has commenced crushing ore from the mine of the company.

Mammoth Channel—At this property, Magalia, a new engine and hoist have been installed and the shaft is being enlarged. Funds are in hand to carry on the work of more effective prospecting of the channel.

CALAVERAS COUNTY

Black Metal—The new hoist has been completed, to be run by water power. The mine is being worked through an incline.

EL DORADO COUNTY

Union—This mine, near El Dorado, now has 73 men on the pay roll and 20 stamps of the mill are running. Twenty more will soon start. Large quantities of sulphurets are being shipped. It is expected that the mine will be provided with 100 stamps during this summer.

INYO COUNTY

Lost Burro—This group in Ubehebe district has been investigated by Los Angeles men with a view to purchase for $60,000. There are six claims in the group.

MONTEREY COUNTY

Chualar Cañon—A company is about to be organized to develop mines in Chualar cañon. Geo. V. Barlow and O. Hallet are the principal owners.

Cruikshank—It is reported that a rich strike has occurred in this old mine in Los Burros district. This was the first mine to be exploited in that district and at one time very high-grade ore was taken out. Labor is somewhat scarce in that section.

NEVADA COUNTY

Lecompton and Norambagua—These two mines have been separately incorporated with the following directors: A. Gilbert, Santa Barbara, H. S. Abbott, Nevada City; H. K. Gilbert, Chicago; J. C. Anderson, New York; W. G. Griffith, Santa Barbara, Cal. The Lecompton is near Nevada City and the Norambagua near Grass Valley. They are both under bond to H. K. Gilbert, of Santa Barbara. The Norambagua is being worked and the Lecompton will soon be pumped out and developed.

Pittsburg-Gold Flat-Potosi—A new company, Mark B. Kerr, general manager, will retimber the Pittsburg shaft to the drain tunnel and the drain tunnel will be put in order. After a survey is made it will be determined whether to operate through the old shaft or sink a central shaft to develop the three properties under control of the company.

SAN BERNARDINO COUNTY

The camps on each side of the Ivanpah valley, which is crossed by the Salt Lake railroad between Cima and Goodsprings, are prosperous at present, numerous discoveries having been made. These are Kewahnee, Ivanpah, Clark, Goodsprings, Keystone, Lyons, Crescent, Vanderbilt, New York and Death Valley districts.

SHASTA COUNTY

Shasta Gold Belt Mining Company—This organization owns mines six miles west of Redding and is doing considerable development work. Machinery is also being put up. A. L. Nichols is superintendent.

Conner—The group of mines owned by E. P. Conner & Sons on Salt creek, near Middle Creek station, has been bonded to New York men represented by M. T. Whitlock, of Kennett. There are both gold and copper claims on which work will be commenced shortly.

SIERRA COUNTY

Gray Eagle—At this mine, Gold Point, W. L. Turner, superintendent, a number of improvements are being made and 10 more stamps will soon be added to the present 30-stamp mill.

Sierra Buttes Mining Company—The old No. 6 tunnel at Sierra City is being reopened and retimbered in order to mine ore which the English company is supposed to have left.

Alaska Mining Company—The station at the 500 level has been timbered and the work of sinking is being continued. The bottom of the old works has been reached.

Jersey—This group, between Omega and Kanaka creek, has been sold by C. C. Slattery and the new owner will at once extend the 1500-ft. tunnel to tap the channel.

SISKIYOU COUNTY

Scott Bar—The company, which has been digging ditches for the past six months, is to build another three-mile ditch to tap Kelsey creek; and a four-mile ditch up into the cañon to tap Scott river. They are preparing to pipe the high channels near Scott Bar.

TRINITY COUNTY

Trinity River Tunnel Company—The 1450-ft. tunnel through Horseshoe bend near Lewiston, lacks only about 100 ft. of completion, and will be finished shortly. The tunnel is expected to carry the entire flow of the river for nine months each year, during which the bed at Horseshoe bend may be mined.

West Point—This company, which has under bond the Leas & Nicholson group at Deadwood, adjoining the Brown Bear group, is running a lower tunnel to tap the vein.

TUOLUMNE COUNTY

New Albany—A strike of exceptionally rich ore has been made while stoping on the 300 level.

Karnac—This company has obtained possession of the Hancock quartz mine four miles west of Rawhide. The company has also an option on the Sarah Marble claims, owned by the Barnard Brothers.

United Mines Corporation—This company has 100 men taking out ore from East lode properties. These are the Grizzly, New Albany, Lady Washington and Head Horse. Good ore is being taken from the New Albany.

Colorado

BOULDER COUNTY

Pittsburg & Gold Hill M. Company—W. R. Crockett, of Boulder, has taken the contract for the erection of a 15-stamp concentrating mill on the company's property at Rowena, and a half mile tramway is to be built to connect mine and mill.

Smoky Hill—A. Berger and associates, of Denver, have opened up good ores and are arranging for the installation of a compressor plant at Sugar Load mountain.

Black Swan—O. H. Brown & Co., Denver, have purchased the mill and will remodel it from a stamp mill to a modern cyanide plant for the purpose of handling custom ores as the product of the Sunshine mine near Salina.

CLEAR CREEK COUNTY

Geneva Extension, M. M. T. & C. Company—Eastern people have become interested in Peru district and E. K. Cass, of Georgetown, Colo., is in charge of operations.

Kennedy Mining Company—Boston capitalists are interested in subscribing a large sum of money for the development of the Centennial property near Georgetown.

Griffith—A new company is being formed with W. D. Hover, Georgetown, Colo., as manager. The company will erect an electro-chemical milling plant of fifty tons capacity for the treatment of its ores.

Philadelphia, M. & T. Company—Philadelphians are interested in the purchase of a group of claims at Kelso mountain, formerly owned by J. T. Hamill. Their office is at Georgetown, Colo.

Magnet—This group on Saxon mountain has been bonded by G. Laughlin, of Chicago, Ill., the bond calling for $80,000 of which a cash payment of $20,000 has been made.

GILPIN COUNTY

King Bee, G. M. Company—A good strike is reported on the Wellington No. 6 vein of this company, in lateral workings of the Newhouse tunnel and at a depth of more than 1700 ft. R. L. Martin, Quincy building, Denver, Colo., is manager.

Great Bonanza, G. M. & M. Company, Ltd.—British capital is interested and they have commenced developments on their Next President group of claims and are overhauling their Eagle amalgamating and concentrating mill at Black Hawk. C. C. Morgan, Central City, Colo., is manager and it is reported that the company will install the Elmore oil process.

Concrete Group—Edgar S. Moulton, of Central City, Colo., has purchased the mine from the Rocky Mountain National bank. Mr. Moulton has been operating it under lease since last June. Arrangements are being made for the deeper workings.

Sherman & Macon, M. & M. Company—A good strike is reported in the main tunnel. F. L. Branham, Central City, Colo., is superintendent.

Hawn—Boulder people have purchased the property in Moon gulch and are preparing to develop it on a liberal scale. It is situated near the Smuggler.

Rocky Mountain Concentrator—Edgar S. Moulton, of Central City, will remodel the plant in Black Hawk, and will install new stamps, jigs and other machinery, increasing its capacity.

LAKE COUNTY—LEADVILLE

Bartlett Tunnel—Under the new management this property, Sugar Loaf district, will be extensively worked. While the tunnel was being driven several veins were cut, all showing ore, and it is the intention of the management to develop them thoroughly. The Bartlett vein will also be worked, and the tunnel driven ahead to catch the northern extension of the Dinero.

Iowa Gulch—Lessees have been at work during the winter on the Ella Beeler and Little Alice, also the Houston, and now have 200 tons of high grade ready to ship as soon as the roads are opened. The principal work has been done through a tunnel driven to the Houston and at this property rich gold ore was caught. The streak is small, but rich. Work has been done on the other claims and high-grade ore found. The three claims are on the same ore belt as the Lilian.

Margaret—In this mine, Granite, in the east drift at the 80-ft. level a few days ago a 3-in. vein of jasper was opened, with free gold. In addition to the rich streak there is a 2½-ft. vein of good milling ore.

Pyrennes—Lessees are driving a drift from the 1000-ft. level, Graham park, to connect with the R. A. M. When this is done extensive operations will be carried on in both properties. When the connection is made all of the hoisting will be done from the R. A. M. shaft.

Sunday Vein—Since the opening of this vein by the tunnel, the width being 12 ft. from wall to wall, the general opinion of mining men is that the vein will carry as far south as Empire gulch, and several will back this opinion up by driving tunnels on intervening ground. This work will be started early next month.

TELLER COUNTY—CRIPPLE CREEK

Callie—Work will soon be commenced in building a new ore house at this shaft. Some time ago some ore was found in the property, but at present no work is being done, as there is no way of disposing of the ore until the new ore house is built. The property belongs to the Stratton estate and is being worked under lease by the Callie Leasing Company, of which H. D. Thompson, of Cripple Creek, is the manager.

Victor—A considerable part of this property which is under lease to the Roscoe Leasing Company, is being worked under subleases. The property is situated on Bull hill and was one of the first shippers in the district. A large amount of ore has been shipped in the past and the company has paid more than its capitalization in dividends. Until recently for a number of years but little has been done on it. The property is owned by the Victor Gold Mining Company, of which D. H. Moffat, of Denver, has the control.

Illinois

Deering Coal Company—The United States Circuit Court at Chicago on March 4 appointed William C. Niblack receiver of the property upon application of creditors and stockholders. It is declared that the company is being pressed by creditors to whom it owes $1,000,000, and that it will be unable to meet the interest on its bonded debt ($5,000,000 first mortgage 5s, of which at last accounts $550,000 were in the treasury and $324,000 in sinking fund; also $96,000 Wilfred Coal Company first mortgage gold 5s). The company, it is alleged, has year contracts with the Illinois Steel Company, the American Steel and Wire Company, the American Bridge Company, and the American Tin Plate Company, to furnish annually from 900,000 to 2,000,000 tons of coal, but is unable to collect $215,000 due from these companies because of damage claims which the Dering company alleges to be without basis. The property includes a number of mines in Illinois and Indiana.

Kentucky

Bell-Jellico Coal Company—A controlling interest has been sold to A. S. Braznell, of

Pittsburg, and associates. The company owns the largest operating mines in the Jellico district.

Michigan

COPPER

Arcadian—At the recent meeting of this company it was decided to sell its lands in Section 16 and also the main property to a new company which will soon be organized under the laws of Michigan, and which will in all probability take adjoining lands and begin operations on the northern extension of the Baltic lode.

Calumet & Hecla—This company continues exploratory work on the White Pine property in Ontonagon county. Trenching is going on with encouraging results.

Cliff—This company is carrying on diamond-drill operations close to the northern boundary of the Ojibway property, in view of opening the Kearsarge lode.

Michigan—A much better showing is being made at the A shaft, near the 17th level. The Calico lode is being opened by crosscuts. The shaft is on the hanging wall side about 75 ft. from the formation. Exploratory work has been started on some old workings lying in the eastern part of the property.

Copper Range—A much better grade of mineralization is being revealed in the lower workings of the Trimountain property at No. 4 shaft. Below the 13th level is an exceptional showing of good stamp and mass copper. At No. 2 shaft drifts on the 14th level are entering better ground.

Keweenaw—Sinking continues in the Medora shaft below the 16th level. At the 13th level a drift is being extended to the north to intercept the fissure vein that was exposed at the 11th level, and which promises to become an important factor in this company's development. Rock shipments aggregating about 110 tons daily are being made to the Phœnix mill.

Ojibway—At No. 1 shaft the crosscut from the 660-ft. level has entered the west bed of the Kearsarge lode and the mineralization exposed is even richer than opened at the level above. This bed is separated from the first, or east bed, by about 20 ft. of trap rock. At No. 2 shaft the crosscut from this same depth is in about 50 ft. on its way to cut the formation and has about 30 ft. more to go.

Superior—The 7th mill run put through the Atlantic mill yielded about 70 lb. of mineral to the ton of rock stamped, making about 50 lb. of ingot copper. This remarkable showing was made from the rock coming principally from the lower openings and a small portion from the stock pile.

Arcadian—Plans are being formulated for the organization of a new company to assume control of the Arcadian. The new company will be organized under Michigan laws and will have a capitalization of 150,000 shares, par value $25. Holders of Arcadian stock will be given share per share, but as the new company's stock will be assessible. Funds will be provided in this way for the development of the property. The sale of lands in section 16 to the New Baltic Exploration Company will give the company sufficient funds to resume operations without calling an immediate assessment. The Arcadian has a complete exploratory outfit and a shaft down about 200 ft. in close proximity to the trend of the formation recently opened at the New Baltic.

New Baltic Exploration—Trenching continues at this property and some very fine specimens of copper-bearing rock have been revealed, showing all the characteristics of the Baltic lode and it is believed by the management to be the northern extension of this formation.

Missouri

JOPLIN ZINC-LEAD DISTRICT

Old Dominion—Six men were killed in a cave-in at the Buxton & Owens mine. The old Dominion has purchased 80 acres in Gordon hollow for $30,000.

Live Oak—The mill belonging to Husman Brothers, of Joplin, has been destroyed by fire.

Carnation—A rotary crusher is being installed to take the place of the regulation Blake crusher and rolls.

Lockport Mining Company—Short creek bottoms at Galena have been successfully drained and 16 lessees are already at work.

Montana

BUTTE DISTRICT

Amalgamated—The Little Mina mine of the Parrot company is fast proving to be the big producer of that company. The shaft is nearly 1200 ft. deep. The principal development work is being done on the 600-, 800- and 1000-ft. levels. On the 1000-ft. level the vein south of the shaft has been opened up a distance of more than 700 ft. An auxiliary engine is being used for sinking the shaft, but plans are being made for the installation of a new hoisting engine, good for 2000 ft. The Parrot shaft is down 2000 ft., and work is being done on the 1200, 1400, 1600, 1700 and 1800 levels. On March 3, at the Diamond mine of the Anaconda company, a premature blast in the sump caused the death of four men working in the shaft. The shaft is now down 2500 ft., and sinking is still in progress.

Butte-Milwaukee—A deed has been recently filed for record conveying from the John Caplice Company to the Butte-Milwaukee Company an undivided three-fourths interest in the Bird quartz lode mining claim.

Butte-Knickerbocker—At the recent annual meeting of stockholders the following were elected directors for the ensuing year: George H. Roberts, of Boise, Idaho; F. L. Cobb and Edwin Higgins, of New York; B. F. White, of Dillon, Mont.; James Davidson, William Dyer, E. E. Kinerk, J. F. Saville, T. W. Bradley, J. M. Montgomery and George B. Conway, of Butte. Of these G. B. Conway was elected president; James Davidson, vice-president; B. F. White, treasurer; and William Dyer, secretary. The company's property is situated in the district immediately north of Butte.

East Butte—A vein carrying commercial ore has been recently encountered in the crosscut on the 900-ft. level south of the shaft. Drifting has been done for a distance of about 25 ft., and the management states that the vein shows a width of 7 ft. and an average assay of 9 per cent. copper and 20 oz. silver per ton.

Butte-Montana—A special meeting of stockholders has been called for March 20 to consider the plan to sell the company's property to the Butte-Alex Scott Company. Thomas A. Merritt, of Duluth, representing the Alex Scott Company, has submitted the plan that the old stockholders be given the opportunity of subscribing to the new company's stock on the basis of one share of the new for 10 shares of the old and a payment of $2.

JEFFERSON COUNTY

Comet Mine—This property has been closed down indefinitely. For the past six months the pumps have been kept in operation, but it has been several months since any development work has been done.

MISSOULA COUNTY

Iron Mountain Tunnel Company—This property, valuable principally as a silver-lead producer, is situated at Carter, Mont. A shaft has been sunk from the top of a mountain to a depth of 1700 ft. This connects with a tunnel one mile in length, driven in the side of the mountain. Work has recently been resumed and a new compressor and hoist are being installed.

POWELL COUNTY

Butte & Elliston—The company's properties are six miles from Elliston. About 20 men are now employed. Two carloads of ore were shipped during the last 30 days to the Pan Handle Smelter in Idaho. The management states that the net smelter return on ore shipped was $900 per car. The ore carries gold, silver and lead.

Nevada

CHURCHILL COUNTY—FAIRVIEW

Nevada Hills—The station recently cut on the 350-ft. level is in a high-grade ore,

the principal value being gold with some ruby silver. The orebody, as found on the 200-ft. level had a pitch to the south, and contained silver alone. It was intercepted by a quartz dike, and at the 300-ft. level the ore now occurs beneath the dike.

Nevada Hills—The strike recently made on the 350-ft. level of this property has improved much with development and the orebody shows a width of 6 ft. which assays from $30 to $40 per ton gold and silver in the proportion of 3 to 2.

CHURCHILL COUNTY—WONDER

Nevada Wonder—A ten-stamp mill is to be erected on this property. Francis L. Bosqui, the engineer who planned the system of ore treatment for the Goldfield Consolidated has made preliminary tests that warrant a satisfactory recovery from the ore.

Nevada Wonder—It is reported that the Nevada Wonder will erect a mill on its property, which report is strengthened by the fact that engineers have been making extensive surface surveys recently.

Wonder Vulture—The directors of this company have issued a circular letter to the stockholders asking for contributions amounting to ½c. per share to take care of a judgment and a number of small outstanding bills.

ESMERALDA COUNTY—GOLDFIELD

Phonolite Paymaster Mining Company—About 1000 feet of tunnel and shaft work has been done at a cost of $10 per foot. The miners have taken their pay in treasury stock at 25c. per share. The property is located near Phonolite, Nev.

Gold Bar—A good grade of ore is being taken out above the 200-ft. level; and also from the 300-ft. level. Development work is being carried on at the same time.

Consolidated Red Top Lease—A 4-ft. vein of ore has been opened up in the new stope above the 300-ft. level; the ore is farther south than in the old ore shoot, and toward the Red Top workings, which are being worked by the Consolidated Mines Company.

Black Eagle—The shaft, which is down 100 ft., will be pushed to the 150-ft. level when laterals will be extended across the formation. The property is 8 miles northeast of Goldfield.

Kansas City Velvet Lease—Small shipments are being made from this property, the ore being extracted at a shallow depth. The main shaft is 300 ft. deep.

Goldfield Consolidated—At a meeting of the directors held in Washington, D. C., Feb. 25, a dividend of 30c. per share was declared, payable April 30 to stockholders of record March 31. This amounts to $1,080,000 and leaves over $1,000,000 in the treasury.

Little Florence—Ore of a low grade has been encountered on the 350- and 500-ft. levels of this property. The ore is identical in character with the high grade from other properties.

HUMBOLDT COUNTY—SEVEN TROUGHS

Reagan Lease—Development work shows better ore on the 300-ft. level.

A rich strike has been made in the north drift of the 300-ft. level where milling ore 3 ft. wide is showing with a narrow high-grade streak of shipping ore. The ore shoot is thought to be a continuation of the ore exposed in the 165-ft. level from which one carload sent to the smelter returned $1030 per ton.

NYE COUNTY—BULLFROG

Pioneer Lease—The crosscut on the 210-ft. level intercepted an orebody Feb. 21, and has penetrated the same 15 ft. without reaching the hanging wall. The ore has been sacked as broken down and stored in the mine pending the construction of larger ore bins. A shipment of two carloads was made Feb. 28.

Pioneer Extension—A contract has been let for 100 ft. of sinking; the shaft is to be double compartment 4x8 ft. in the clear.

National Bank—Settlements for the last shipment from the Logland lease, to the smelter at Needles, show three tons yielding $463 per ton, and 34½ tons $68 per ton.

Tramps—The main tunnel is now in 1400 ft. A hoist has been installed near the face and a winze sunk 100 ft., from the bottom of which a crosscut was run to cut the Tramp vein. This vein has now been penetrated and shows 12 ft. of milling ore.

NYE COUNTY—ROUND MOUNTAIN

Valley View—An impotrant ore discovery was recently made in the incline. The vein varies from one to five feet in thickness and assays $20 to $25 per ton. The vein is pure white quartz and is different from anything heretofore found in the district.

Jefferson Mining Company—James MacDonald has been engaged as manager. The old workings of the Kanrohat property will be thoroughly prospected before anynew development work is carried on.

NYE COUNTY—TONOPAH

Midway—Prospecting for new orebodies is being extensively carried on in the second, third, fourth and sixth levels, with stoping on the third and fourth levels.

Belmont—The most noteworthy feature shown by the past week's development is the increased size of the orebody exposed in the east drift from a winze sunk from the 1000-ft. level, which now varies from six to seven feet, carrying a good grade of ore. Stoping is being carried up from the 1100-ft. level; in two places the backs being 20 ft. and 60 ft., with 125 ft. between.

Tonopah Extension—General Manager Kirchen has just returned from attendance at the directors' meeting in New York City and states that a 30-stamp mill will be constructed within the next few months.

NYE COUNTY—HELENA

Broken Hills—Reports from this property indicate satisfactory results from development work. In the main workings the company has encountered a body of high-grade ore of the same character as that previously shipped; 2000 sacks are piled on the dumps and shipments are made at the rate of 15 tons per day, the ore running between $140 and $150 per ton.

New Mexico

GRANT COUNTY—SYLVANITE

Men from Cripple Creek, Colo., have obtained an option on three of the first claims staked in the camp, the Broken Jug, Golden Eagle, and Wake-up Charley. A cash consideration was paid for the option, which extends until March 1, and which gives the purchasing parties the privilege of buying a controlling interest, or nearly 60 per cent. of the stock in all three of the claims. The owners of the properties are, C. F., J. N. and E. J. Clark, who were the original locators, together with W. M. Carlin, Marvin Ish, Sol Camp and J. T. Goshen, holding altogether 700,000 shares of the stock, the other 300,000 remaining in the treasury. If the property is taken, work will be commenced at once upon a new shaft, probably near the line of the Broken Jug and Golden Eagle, and work prosecuted without any delay, modern machinery installed, and as many men put to work as can conveniently be handled.

SIERRA COUNTY

Monarch—The company is making extensive improvements in its plant. A large settling pond has been built, the water from which will be pumped back over the jigs and tables. The coarsest material is to be separated in jigs, while the slimes are treated on tables, the lead being saved by the first set and the zinc on the second, the contract being that the plant shall make a product having not to exceed 2 per cent. zinc in the lead concentrates and 1 per cent. lead in the zinc concentrates and not more than 10 per cent. of total loss in the tailings. The Galena Iron Works, of Galena, Ill., is remodeling the mill.

SOCORRO COUNTY

Tri-Bullion Smelting and Development Company—The mines are now producing and shipping smelting ore at the rate of about 100 tons a day, the ore being essentially zinc-bearing, but containing a small quantity of copper. The company intends to proceed with the construction of a smelting plant at Canon City, Colo., at an early date.

Oregon

Baker County

Intermountain Mining Company, Ltd.—W. L. Vinson, the former owner of the mine, has transferred the control to the new company, with headquarters in Baker City. The group of 16 mining claims is 18 miles southeast of Durkee, in Baker county. Tunnel No. 3 is now in the mountain about 600 ft., with a depth of 300 ft. below the apex. Tunnel No. 2, just above tunnel No. 3, cuts the orebody 100 ft. below the surface. This vein is from 3 to 6 ft. in width. A winze started down in tunnel No. 2 shows that the orebody is widening as depth is attained. There are several veins of ore on this group of claims, all showing pay ore on the surface. The ore is free milling and is easily saved on the plates. There is a 20-stamp mill on the property with a capacity of 60 to 75 tons per day. The company has water right sufficient to run 1000 stamps and owns 240 acres of good timber land, situated 4½ miles from the mine. The officers are M. S. Bond, president; Thomas Proffitt, vice-president; W. J. Patterson, secretary and treasurer; John H. Washburn, general superintendent.

The Irondyke—In the extreme eastern portion of Baker county there is some activity in the copper-mining industry. The Irondyke is owned by capitalists of Erie, Penn., and is managed by Frank E. Pearce, with headquarters at Homestead. One shaft is down about 700 ft. There are numerous tunnels, crosscuts, upraises and drifts amounting to about a mile of underground workings. The Irondyke is one of the best equipped copper mines in Oregon. The property is 60 miles from the railroad.

Peacock—Mr. Boggs, the manager and lessee, announces that as soon as the railroad is finished to Homestead, he will build an aërial tramway from the mine, across the river, to the O. R. & N. docks.

Sumpter District—The Columbia, Old Redboy, and the Imperial are operating with a full force of men. The Redboy is furnished with light and electric power from the recently installed Olive Lake Power Company.

Virtue Mine—This is an old mine and is under the management of J. K. Romig, of Baker City. It is operated by electric power, and is lighted throughout by electricity.

Uncle Dan—A few miles beyond the Virtue is the Uncle Dan mine, under the management of C. S. Blackmon, who is also the principal owner of the property. He is sinking the shaft down to the 300-ft. level. The mine is also operated and lighted by electricity.

Grant County

Standard Mine—The Susanville district is 60 miles west of Baker City; the Standard mine is operating in a small way, and has what is considered the only paying deposit of cobalt ore in the northwest.

Pennsylvania

Bituminous Coal

Monongahela River Consolidated—The results of operations for the first quarter of the fiscal year—Nov. 1-Jan. 31—are reported as follows:

	1908.	1909.	Changes.
Net earnings..	$ 680,254	$ 195,970	D. $ 484,284
Charges	478,323	384,191	D. 94,132
Surplus.....S.	$ 201,931	D.$ 188,221	.....

Charges this year were made up as follows: Depreciation fund on coal mined, $78,148; depreciation of equipment, $105,002; taxes and insurance, $78,751; interest, $122,290.

South Dakota

Custer County

Hartwell—President Hart, of Chicago, is directing the work in the main tunnel, now in 345 ft., and will soon start drifting on the ledge.

Saginaw—The mill is dropping ten stamps regularly and making good monthly cleanups. The vein where the main work is done averages 8 ft. thick.

Lawrence County

Eskimo—The Regan brothers, of Lead, report a good strike on their Yellow creek property. A vertical ledge has been opened up that appears to be permanent.

Homestake—Sinking has been resumed in the Ellison shaft at Lead. This shaft is down 1700 ft., being the deepest one in the district. At Nemo the company is commencing a small shaft on a copper ledge that has just been found.

Pennington County

Forest City—It is reported that the main ledge, which was lost in a fault some years ago, when the Clara Belle company operated the mine, has been found and is now being opened up at Oreville. It is 8 ft. wide.

Utah

Beaver County

The Frisco Consolidated Mining Company—This is a new company formed with a capital of 1,500,000 shares, par value $10 each. Malcolm, Green & Co., of Boston, have underwritten 17,000 shares at $2 per share; 25,000 shares will be placed in the treasury. The Frisco Contact Company receives 103,750 shares; the North Horn Silver Company, 1000 shares and $7000; the Glorious Company, 3240 shares and $2500, and the Good Hope Company, $2000. The consolidated company has 31 claims and the property is considered one of the best in the district. It is equipped with a good hoist, compressor and pumping machinery.

The Lady Bryan—C. T. Birchard, of Boston, has purchased five claims in the Star camp just south of the Hub. In former years the property produced rich ore.

The Leonora—The main tunnel is now in 155 ft. and shows some ore in the face. The property adjoins the Red Warrior.

Millard County

Millard Iron Mining Company—A quartz vein carrying gold and silver has been encountered in the shaft at a depth of 45 feet.

North Billy—Surface development has exposed gold-bearing rock.

Salt Lake County

Cardiff—Connection between the old and new workings and drain tunnel has been made. This will give a stoping back of 100 feet.

Tooele County

The Lion Hill—Good ore has been encountered at the bottom of a Winze sunk from the tunnel level. The vein is 7 ft. wide and contains from 8 to 10 per cent. lead, with silver and some gold.

Utah County

Dutchman Company—Four feet of lead carbonate ore has been cut about 100 ft. from the surface.

Canada

Alberta

The report of the Minister of Public Works for the Province of Alberta, recently submitted to the provincial legislature, states that in 1908 a total of 2,046,308 tons of coal was produced by 112 mines in the Province. The number of men employed was about 3500, and their wages ranged from $75 to $180 per month. Durin the year there were 62 coal-mine accidents, 11 of which were fatal.

As the existing agreement between the coal-mine operators and the men will shortly terminate, a joint meeting of representatives of the Operators' Association and the United Mine Workers of America has been called for the first week in March, to formulate a new agreement. For some time past reports have been in circulation to the effect that there will be a general cessation of work by the men until such time as they shall obtain more favorable terms, but this is denied by prominent officials of the local district who hold the view that "there is no likelihood of a shut-down, and that the adoption of such a course by either operators or men "would be suicidal."

South Alberta Irrigation Company—At Bow island this company has struck, at a depth of less than 2000 ft., a pressure of natural gas stated to be equal to about 7,000,000 cu.ft. per day. This flow is much greater than that met with earlier in the "Old Glory" well at Medicine Hat, where the flow is placed at about 4,500,000 cu.ft. per day.

West Canadian Collieries, Ltd.—During the latter part of February this company has been sending out from its Bellevue colliery 1200 to 1300 tons of coal per day, and on one day made its record output of 1350 tons. The company owns several collieries in the Blairmore-Frank district, and has its head quarters in the province at Blairmore. C. L. Rameau is general manager.

Scranton Coal Mining Company—This company has acquired the adjoining property, heretofore owned by the Central Mining Company. The combined holdings include 1500 acres of land. It is proposed to increase the output to 1000 tons of coal daily. S. Tanner, Spokane, Wash., is secretary and treasurer.

British Columbia—Rossland

Cabled advices from London state that the Le Roi No. 2, Ltd., which company has its headquarters in that city, has declared a dividend of 2s. per share, payable March 11. The authorized capital of this company is £600,000 in 120,000 shares of £5 each. Its output of shipping ore last year was about 30,000 tons averaging rather less than 1 oz. gold, 1 oz. silver per ton, and 1.6 per cent. copper. Its second-class ore, which is concentrated at the mines, runs about $3.50 per ton in all values. Paul S. Couldrey, of Rossland, is general manager.

British Columbia—Nelson

The president of the Associated Boards of Trade of Eastern British Columbia, in his report to the annual convention of delegates gave the following table showing the production of minerals and lumber in Southern Kootenay and Southern Yale during 1908:

Gold, 252,000 oz. at $20.67	$5,208,840
Silver, 2,988,000 oz. at 55c	1,643,400
Lead, 21,583 tons at $70	1,510,810
Zinc, 10,000 tons at $16	160,000
Coal, 582,000 tons at $3.50	2,037,000
Coke, 235,000 tons at $6	1,410,000
Total value	$17,557,025
Lumber and ties, 100,000,000 ft. at $15	1,500,000
Total	$19,057,025

Nova Scotia

Dominion Coal Company—The output for February amounted to 201,570 tons of coal against 282,000 for February, 1908. March 3 the mine at Dominion No. 6 was closed down, throwing 500 men out of employment. The shutdown is for an indefinite period, only sufficient men to attend to the pumps being retained.

Ontario

Globe Refining Company—Port Elmsley, Lanark county, Ont. This company, of which Rinaldo McConnell, Ottawa, is president, has undertaken the manufacture of plumbago and installed a plant.

Ontario-Cobalt District

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 27, were as follows: Crown Reserve, 296,900 lb.; Cobalt Central, 40,375; City of Cobalt, 60,000; La Rose, 259,050; Nipissing, 212,675; Right of Way, 122,490; Trethewey, 65,000; total, 1,056,490 pounds.

Cobalt Lake—The annual meeting was held at Ottawa Feb. 27. The financial statement presented showed working expenses $142,554, and proceeds including amounts due from smelter and value of ore on hand, $83,547. During the year 3272 ft. of work had been done, comprising 3138 ft. of drifting and crosscutting, and 134 ft. of sinking, in addition to 18,000 cu.ft. of stoping.

Crown Reserve—Rich ore is being taken out at the 135-ft. level, the lowest depth worked. Assays show silver contents of 8500 oz. to the ton.

Chambers-Ferland—Two strikes were made this week. One vein was found in No. 1 shaft slope, and the other at the 80-ft. level in No. 2 shaft.

Kerr Lake—Three new veins have been discovered at the 100- and 150-ft. levels, giving a total width of 35 in. of ore. The Lawson vein has been cut at the 200-ft. level where it yields 7 in. of rich ore.

La Rose—Drifting is being done at the 180-ft. level on the big vein in both directions from the raise made from the 100-ft. to the 200-ft. level, and rich ore is being taken out.

Nipissing—During February $75,000 of ore was taken out from sinking operations alone on the Fourth of July shaft, which is now down 165 ft. It will be put down to 200-ft. level before drifting is begun. The five veins found in the shaft at a depth of 125 ft. have united, forming 8 in. of ore. At the depth of 210 ft., vein 26 runs from 8 to 14 in. in width and the ore yields 4000 oz. of silver to the ton.

Right of Way—A quarterly dividend of 6 per cent. with a bonus of 9 per cent. has been declared payable April 1. A 6-in. vein carrying silver has been found at the 100-ft. level.

Ontario—Montreal River District

Otisse—A small vein encountered in the shaft at 43 ft. has steadily widened with depth and increased in silver contents. At 55 ft. it has developed into a strong vein with ore assaying 3000 oz. to the ton, the walls on each side also carrying silver making a shipping body 3½ to 4 ft. in width.

Mexico

Chihuahua

Cia Minera Londres—The lead-silver-zinc mine is nine miles from Guzman, on the Sierra Madre railway, and 79 miles from El Paso. Dr. Samuel Blair, of Albuquerque, N. Mex., is managing director and J. D. Hedding, general manager. The equipment includes 10x14 Ottumwa engine, 100-horsepower boiler, compressor and machine drills. The ore occurs in pockets along a lime-porphyry contact. Thirty-five Mexican miners are employed. Wages range from 85c. to $2 per day. Two machines are operated on the seventh level. On this level a new oreshoot has been found. The work is done by contract, the prevailing price being $6 per ft. Coal costs $8 per ton, laid down at the mine, and ore is hauled to the railway at $3. Excellent stone houses are furnished miners.

San Pedro—The Candelaria mine has installed a new pump, and is now shipping a small quantity of ore.

Cerros Colorados—The opening up of a large body of shipping-grade lead-silver ore at the Creel mine in the Cerros Colorados section to the east of Villa Ahumada is reported. Assays show 50 oz. silver and 50 per cent. lead. The property is under development by Mexico City men represented by Sr. Manuel Lujan, of Chihuahua.

San Toy—Daily shipments of more than 100 tons of 40-oz. silver ore are being made from the Juarez mine and production will be shortly resumed at the Galeana mine, doubling the present output. Donald B. Gillies, the manager of the company, as well as other Schwab mining interests in the United States and Mexico, is now spending most of his time at Chihuahua directing San Toy operations.

Guerrero

Balsas—Work is nearly completed on the 100-ton copper-smelting plant for the Maine & Nebraska Mining and Smelting Company. This work is in charge of Walter E. Koch, of El Paso.

Sonora

The Tigre Mine—The company is working 250 Mexicans, treating about 100 tons of ore a day and shipping about 300 tons of concentrates a month. Robert Musgrave is manager.

Sonora Copper Smelting Company—Shipments of ore are being made to the El Paso smelter. Over a mile of underground work has been completed. A. M. Conrad is manager. The main working tunnel is in 1300 ft., which gives a depth of 650 ft.

Harris Copper Company—A core drill is being used to prospect the La Caradad mine, Nacozari; other development is discontinued.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 10—The coal trade in the West shows some improvement, and in several quarters mines are reported running on longer time and with increased orders. At the principal centers an improvement is reported in the demand for steam coal.

A set-back to optimistic sentiment has been given by the receivership for the Deering Coal Company. This is one of the large combinations made at the hight of the prosperous period and heavily capitalized. It is uncertain what the result may be, but the company has evidently felt seriously the effects of the past year. The report of the Pittsburg Coal Company, just issued, shows that it has passed the worst year in its history but has been able to meet its obligations.

In the East the bituminous-coal trade continues quiet. The Seaboard trade shows some improvement, but rather slow, although producers are beginning to feel more hopeful.

In conference with representatives of some of the anthracite companies the miners' leaders have arranged for a meeting to be held on March 11 to consider the proposed new agreement. This will be only a preliminary meeting, however, and it is not at all likely that any definite results will be reached until later. The strike talk, however, is not quite so loud.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 27, short tons:

	1908.	1909.	Changes.
Anthracite	857,717	769,675	D. 88,042
Bituminous	5,246,482	5,519,214	I. 272,732
Coke	1,161,703	1,624,222	I. 462,519
Total	7,265,902	7,913,111	I. 647,209

The total increase this year to date was 8.9 per cent.

Coal and coke tonnage reported by the Pittsburg Coal Company for the year ended Dec. 31, short tons:

	1907.	1908.	Changes.
Pittsburg district	18,005,382	13,217,545	D.4,787,837
Hocking district	1,348,112	1,064,586	D. 283,526
Total coal	19,353,494	14,282,131	D.5,071,363
Coke	456,933	55,099	D. 401,834

The decrease in coal in 1908 was 26.2 per cent.; in coke, 87.9 per cent.

Coal shipments of the Monongahela River Consolidated Company for the three months of its fiscal year from Nov. 1 to Jan. 31, short tons:

	1908.	1909.	Changes.
River coal	1,523,765	910,929	D. 612,836
Rail coal	417,242	198,124	D. 219,118
Total	1,941,007	1,109,053	D. 831,954

The total decrease in shipments this year was 42.9 per cent.

Anthracite shipments in February were 4,576,004 tons, being 607,341 tons less than in January, and 72,248 tons less than in February, 1908. For the two months ended Feb. 28 the shipments were, in long tons:

	1908.	1909.	Changes.
Reading	1,933,434	1,982,656	I. 49,222
Lehigh Valley	1,703,580	1,642,908	D. 60,672
N. J. Central	1,324,302	1,204,980	D. 119,322
Lackawanna	1,573,001	1,357,001	D. 216,000
Del. & Hudson	1,071,627	1,037,869	D. 33,758
Pennsylvania	961,004	859,088	D. 101,916
Erie	1,107,954	1,214,583	I. 106,629
N. Y., Ont. & West.	447,193	460,264	I. 13,071
Total	10,122,095	9,759,349	D. 362,746

Three companies—the Philadelphia & Reading, the Erie, and the New York, Ontario & Western—report increases. The others show decreases, the largest being on the Delaware, Lackawanna & Western. The total decrease this year was 3.6 per cent.

New York

Anthracite

March 10—Business shows no change whatever. Demand has been about on the usual level and domestic sizes have moved very slowly. Steam sizes are a little more in demand and the supply is somewhat better, though it is still not excessive. Strike talk is now waiting for the results of the conference to be held this week.

Prices are unchanged. The list prices for prepared sizes are $4.75 for broken, and $5 for egg, stove and chestnut. Small steam sizes are: Pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.60@2; barley, $1.35@1.50; all f.o.b. New York harbor points.

Bituminous

The soft-coal trade continues rather dull, and the closing of yearly contracts is proceeding very slowly. It does not seem to be easy to agree upon prices, unless producers are willing to work without profit. In current business the far East is sending a few more inquiries, but is not buying much. The Sound is a little more active and more inclined to take coal.

New York harbor is still rather dull. Buyers seem to be inclined to take coal only when they can get it cheap, while producers are rather holding back and are inclined to ship only on orders. Good grades of steam coal are still quoted at $2.40@2.50 f.o.b. harbor shipping point, with lower grades $2.20@2.30 per ton.

All-rail trade is improving a little and is much better than Coastwise business. Car supply is abundant and transportation is fully up to schedule, cars sometimes coming through a day or two before they are expected.

The Coastwise-vessel trade shows no improvement, and captains are almost tired of hunting for charters. Rates are unchanged, those quoted for large vessels from Philadelphia being: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Portsmouth, 80c.; Newburyport, 95c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

March 8—There is no improvement in the coal trade in Southern territory, and several mines are either shut down or running on slack time. All demands can be met and the production can be increased on very short notice.

Coke production is also at a low ebb. The demand amounts practically to nothing. The Tennessee company still has a large quantity of coke on hand for use when the iron production improves.

It has been some time since the coal and coke market in this section has been as quiet as it is now.

Chicago

March 9—A quiet but firm tone exists. The situation as regards demurrage is improving, forced sales being fewer and the quantity of coal coming to market being more nearly uniform from both eastern and western mines. With the probability of cold waves over, the tendency of retailers and consumers is to buy lightly and wholesalers will keep down their stocks correspondingly. Domestic coals still vary greatly with the weather; steam coals are holding steadily and are running to finer coals more largely.

Lump and egg from Illinois and Indiana mines sells in car lots at $1.75@2.50, run-of-mine $1.65@1.75 and slack $1.25@1.50. Smokeless is much firmer owing to restriction of shipments and forced sales are no longer the rule. Lump brings $3.15@3.45 for Pocahontas and New River and run-of-mine, same grade, $2.75@3.15; lower grade smokeless sells for $2.95@3.30 for lump, and $2.75@2.95 for run-of-mine. Brazil block is steady at $2.85.

Hocking Valley holds up to $3@3.15, with the supply held down closely to needs of the market. Youghiogheny is quiet at $3.15 for ¾-in. gas lump. Pittsburg No. 8 is in comparatively light demand at $2.65 @2.75.

The anthracite market has subsided into its usual quiet condition.

Cleveland

March 9—The coal market is dull for the present. Domestic coal has fallen off on account of the weather. Steam coal gains slowly. Prices are low. Negotiations are in progress over supplies for the Lake trade. Something depends upon the rate question, and shippers are waiting the decision of the Interstate Commission on the Pittsburg application for equalization of railroad rates.

Indianapolis

March 8—There has been a slight increase in the output of the coal mines during the past week. The Vincennes division of the Vandalia railroad brought out 50 carloads of coal a day for local shippers who ship it on to points north, some of it going to Chicago and other Lake points. A number of mines on this line have benefited by the transfer of large orders from the Deering Coal Company by the Steel Corporation, and this has taxed the road's facilities considerably. Operators say that the mines are now running from three to six days per week, with orders steadily increasing. It is not believed that the receivership of the Deering company's property will keep that company's mines closed. In some instances, notably in Sullivan county, the Milred and the Willfred, two of the best mines owned by the company, have received orders from the receiver to continue work.

Pittsburg

March 9—There has been no change. The large producers continue to quote on the basis of $1.15 for mine-run coal at mine on both spot and contract. Some small independents, however, are willing to sell at less and some spot sales have been made lately at close to $1 a ton. Large Lake coal shippers are still making contracts with Pittsburg producers for the coming season. The surplus coal of the Pittsburg-Buffalo Company will go to the Hanna interests, which are likely to be the heaviest shipper to the northwestern markets in the summer. The rivers are still navigable; yesterday two large tows went to the Cincinnati market and there is but little left for shipment this week. All the river mines are being operated at capacity, while the railroad mines are not going to more than one-third of capacity.

Connellsville Coke—The coke trade is stagnant and but few contracts for any grade are being made. Large producers continue to hold furnace coke at $1.75 for both spot and on contract, and foundry coke is being quoted at $2@2.25, according to delivery. The prospects at the present time are not regarded as good. The *Courier* gives the production in both fields at 268,852 tons. The shipments were 9630 cars as follows: To the Pittsburg district, 3341; to points west of Pittsburg, 5543; to points east of Connellsville, 746 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished for use of steamships, month of January, long tons:

	1908.	1909.	Changes.	
Anthracite	160,465	165,092	I.	4,627
Bituminous	743,922	549,090	D.	194,832
Total coal	904,387	714,182	D.	190,205
Steamer coal	519,970	427,743	D.	92,227
Total	1,424,357	1,141,925	D.	282,432
Coke	79,120	74,481	D.	4,639

Canada took this year 489,487 tons coal or nearly 70 per cent. of the total.

United States Coal Imports—Imports of coal and coke into the United States, month of January, long tons:

	1908.	1909.	Changes.	
Anthracite	5,909	3,103	D.	2,806
Bituminous	149,117	99,109	D.	50,008
Total coal	155,026	102,212	D.	52,814
Coke	20,156	13,028	D.	7,128

Canada furnished this year 76,141 tons coal and nearly all the coke; Australia, 15,680 tons coal. Imports are chiefly on the Pacific Coast.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 27: Best Welsh steam, $3.36; seconds, $3.24; thirds, $3.12; dry coals, $3.48; best Monmouthshire, $3.06; seconds, $2.94; best small steam, $2.10; seconds, $1.80. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, March 10—The iron and steel markets are gradually adjusting themselves to the new conditions and some increase in business is manifest. The improvement is not rapid, but is going on slowly, as was to be expected under all the circumstances. In some quarters there is a disposition to attribute delay to tariff possibilities, but in others little attention is paid to this. It is manifest, however, that there is a more confident tone and an increasing disposition to place orders for some time ahead and to rely less on immediate purchases.

In the structural-steel market a good deal of business is being done and construction requirements are coming forward rather freely. Inquiries are numerous, though not all of them lead to immediate business. It looks now as though the summer will see a good deal of structural work. In bars a good business has been done and in plates there is also more demand.

The large New York Central order for steel rails has not so far been followed by others; but it is said that some important negotiations are in progress. Several orders for steel cars have been placed and others are expected, while railroad-bridge orders are coming in more freely.

In pig iron there has been a considerable volume of business and though it is mainly in small orders the total volume is increasing, while individual orders show a tendency to advance in quantity. Pig-iron prices are a little variable, and there is more or less shading when a desirable order is in question.

Nothing definite has yet been done about iron-ore prices for the season. The Lake interests are holding back but there is a growing impression that prices will not be materially changed.

The question of wages is still under discussion. The Phœnix Iron Company has ordered a general reduction of 10 per cent. and some smaller companies have taken the same action. At a meeting of the Eastern Pig Iron Association held this week it was resolved that a general reduction of 10 per cent. was necessary, but the carrying out of this was left to the members.

Pig Iron Production—The reports of the blast furnaces, as collected by the *Iron Age*, show that on March 1 there were 232 coke and anthracite stacks in blast, having a total weekly capacity of 421,000 tons. This is an increase of 6500 tons over Feb. 1 and of 19,000 tons over Jan. 1. Making allowance for the charcoal furnaces the production of pig iron was, approximately, 1,726,000 tons in February; for the two months ended Feb. 28 it was 3,547,000 tons.

Canadian Rail Contracts—The Dominion Steel Company has secured a contract for 40,000 tons of steel rails for the Grand Trunk Pacific, the price being $33.50 per ton, delivered at Prince Rupert. The company has also taken a contract for 15,000 tons of rails to go to Australia.

Birmingham

March 8—The Southern pig-iron market shows little improvement. One company announces the sale of quite a quantity of iron, something like 80,000 tons having been disposed of during the first two months of the year. Prices are a little weak. The shipments of pig iron from Southern territory continue steady. The make is holding up well. Two furnaces which are under repair are re-

ported ready to start when the iron is needed. The Southern iron manufacturers will be able to meet all demands when the market improves. The cast-iron pipe companies in this section have recently been bidding on some big contracts and are assured of landing the business. These interests are already in possession of orders that will keep them busy for some time to come. The steel plant at Ensley is still practically in full operation.

The properties of the Southern Steel Company have been advertised for sale and the reorganized company, with W. H. Hassinger president, will in a short time be in possession and will take steps looking to operation.

Pig-iron quotations revolve around $12 to $12.50 per ton, No. 2 foundry.

Baltimore

March 9—Exports for the week included 405,336 lb. spelter, 574 lb. selenium, 2,616,700 lb. steel billets to Liverpool; 2512 tons steel rails and 1,247,810 lb. structural steel to Panama. Imports included 5850 tons iron ore from Cuba.

Chicago

March 9—Buying of pig iron is very light. Practically every melter of consequence is holding off until he sees how the market skies will clear under the clouds of tariff revision, lowered steel prices and recovery of confidence. Hardly a buyer is in the market for last-half iron; the business of today is done on short-order schedule. Sales are for deliveries within 30 to 90 days and for small amounts.

Prices are uncertain. The disposition of furnace agents is to grant concessions and $12 Birmingham undoubtedly represents certain contracts. This means $16.35 Chicago, against $16.50 for Northern iron, No. 2 being quoted in both cases.

Above these amounts 25 to 50c. is obtained on some sales. A prospect of the sale of a large amount of iron on six to nine months' delivery would bring out a low quotation.

An effort is being made by the Southern representatives to hold up prices to $13 Birmingham ($17.35 Chicago) on ordinary purchases. This apparently cannot stand in the face of present conditions.

Philadelphia

March 10—Nothing can be said concerning the pig-iron market that is encouraging either to sellers or buyers. Both forge and foundry continue extremely dull. The makers of pipe iron are encouraged with the belief that a great deal of pipe iron will be wanted within the next 60 days. The mills have been buying very little forge, and foundries are booking very little new business. It was expected that this week would bring out a large amount of business in basic iron, but a hitch has occurred somewhere, the details of which cannot be ascertained.

Steel Billets—Reductions which have been made verified the prediction which had been made all along. The base price of $23 at mill is believed to be the lowest probable level.

Plates—Plates have been very quiet for a week. The demand is for small lots for local requirements.

Structural Material—No large business will be done in structural material until the disturbing influences subside. Just what is disturbing the local market is unknown and the manufacturers have very little to say on the subject, except that the independent manufacturers are occupying a position of antagonism to the larger interests.

Scrap—The scrap market is very much disturbed. Very little material is being sold. The dealers are loaded up, considering the present condition of the market. Prices are merely nominal and buyers are looking for a further weakness.

Pittsburg

March 9—Business in the iron and steel trade has not improved materially. There is a hesitancy on the part of buyers to contract for their spring requirements until there is a more definite understanding as to the future. The market can, therefore, be regarded as a waiting one, but some business must be done regardless of prices as consumers must have material. The uncertainty as to the tariff is the main stumbling block in the way of a good buying movement at this time, and where it is possible to wait until this question is disposed of consumers have decided to do so.

The feature of the finished-steel market this week is the uncertainty regarding wire and wire products. There is fairly good information that before the end of the week the leading interest, the American Steel and Wire Company, will announce a stiff reduction in prices for the spring trade. Jobbers who have been accustomed to fill their warehouses early in March for the spring trade have delayed sending in their orders. Some business has been booked this week, but it has not been up to what actually will be required and there is no doubt but that a concession in the price will bring out a considerable tonnage.

There was some stir in Pittsburg last week when a report was circulated that billets had sold at $20 a ton at mill in Youngstown. This was positively denied by all billet makers in this and surrounding territory. It was admitted that at a meeting held here on Thursday, it had been decided to cut the price of both open-hearth and bessemer billets from $25, Pittsburg, to $23 and to eliminate the division of freight. Sheet bars and tinplate bars were cut from $27.50 to $25.50, Pittsburg, for delivery in Youngstown, Wheeling, McKeesport and Mingo Junction.

Pig Iron—There is scarcely any improvement. Actual sales do not exceed 1000 tons. Inquiries aggregate about 10,000 tons, but of these 6000 tons are for malleable bessemer and come from the East; it is probable the business will be placed in Buffalo territory as the freight rate from the Valley furnaces is heavier. The Westinghouse Air Brake Company is in the market for 1000 tons of bessemer iron. Prices are practically unchanged and are as follows: Standard bessemer, $15.50; malleable bessemer, basic and No. 2 foundry, $15; gray forge $14. It is understood basic can be shaded.

Steel—Merchant-steel bars are now 1.20c. and plates 1.40 cents.

Sheets—Independents are quoting $2 per ton higher than the minimum price supposed to have been announced by the leading interest. Their latest quotation, subject to change, is as follows: Black sheets, 2.30c. and galvanized sheets, 3.35c. for No. 28 gage.

Ferro-Manganese—Prices have dropped $1 a ton; quotations for prompt shipment are $43@43.50, Pittsburg.

Foreign Trade in Iron and Steel

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for the month of January are valued by the Bureau of Statistics of the Department of Commerce and Labor at $13,468,058 in 1908, and $10,329,388 in 1909; decrease, $3,138,670, or 23.3 per cent. Leading items of export, in long tons:

	1908.	1909.	Changes.	
Pig Iron	2,546	3,213	I.	667
Billets, ingots & blooms	5,317	9,506	I.	4,189
Bars	5,507	3,589	D.	1,918
Rails	16,285	13,187	D.	3,098
Sheets and plates	7,888	8,532	I.	644
Structural steel	11,017	6,453	D.	4,564
Wire	12,022	9,123	D.	2,899
Nails and spikes	3,686	3,579	D.	107
Pipe and fittings	6,075	9,166	I.	3,091

Decreases are shown in all the more important items this year.

Iron and Steel Imports—Imports of iron and steel and of machinery into the United States in January were valued at $2,076,766 in 1908, and $1,830,071 in 1909; decrease, $246,695, or 11.9 per cent. The leading articles of import were, in long tons:

	1908.	1909.	Changes.	
Pig Iron	15,387	11,048	D.	4,339
Scrap	678	169	D.	509
Ingots, blooms, etc.	759	1,413	I.	654
Bars	4,066	2,318	D.	1,748
Wire-rods	1,163	1,022	D.	141
Tinplates	5,067	3,267	D.	1,800
Sheets and plates	353	208	D.	145

The only increase reported this year was in ingots and blooms.

Metal Market

New York, March 10—The markets still continue rather quiet, and no improvement is noted for the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1909..	$ 7,865,196	$ 3,412,583	Exp. $4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Year 1909..	7,865,196	3,412,583	Exp. 4,452,613
" 1908..	444,200	10,799,484	Imp. 10,355,284
Silver:			
Jan. 1909..	4,542,254	3,660,052	Exp. 882,202
" 1908..	4,148,144	3,621,874	" 526,270
Year 1909..	4,542,254	3,660,052	" 882,202
" 1908..	4,148,144	3,621,874	" 526,270

Exports from the port of New York, week ended March 6: Gold, $3,278,100, chiefly to Argentina; silver, $1,017,974, chiefly to London. Imports: Gold, $709,148; silver, $70,254, both from the West Indies, Mexico and South America.

Gold—The price of gold on the open market in London continues unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American eagles. The Bank of England is absorbing most of the new supplies. In New York $2,500,000 in gold have been shipped to Argentina, and at the close of the week $3,000,000 are reported taken for shipment to London.

Platinum—Dealers' prices continue unchanged at $23.50@24.50 for refined platinum; $26 for hard metal and $19@21 for scrap. Business is improving a little, but is still rather quiet. Some change is expected soon.

SILVER AND STERLING EXCHANGE

Mar.	4	5	6	8	9	10
New York....	50⅛	50¾	50¼	50¼	50⅝	50⅜
London.....	23 1/16	23 1/16	23 1/16	23⅛	23 1/16	23 3/16
Sterling Ex..	4.8770	4.8780	4.8810	4.8825	4.8820	4.8800

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—Some India bazar and China buying has carried the price up slightly, but there does not seem to be any special feature in the market.

Copper, Tin, Lead and Zinc

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
4	12⅞ @13	12⅝ @12⅝	56¾	28¾	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
5	12⅞ @13	12⅝ @12⅝	56⅞	28⅝	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
6	12⅞ @13	12⅝ @12⅝	....	28⅝	3.92½ @3.95	3.77½ @3.80	4.57½ @4.62½
8	12⅞ @13	12⅝ @12⅝	56½	28⅜	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½
9	12⅞ @13	12⅝ @12⅝	56⅝	28⅜	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½
10	12⅞ @13	12⅝ @12⅝	56¾	28⅜	3.95 @3.97½	3.80 @3.82½	4.57½ @4.62½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—In the week of March 4-10 there were some transactions of important size, chiefly for export. Domestic business was comparatively small. However, some of the large manufacturers appear to have been privately taken care of by certain producers. The price asked of domestic consumers is now 12⅝c., delivered 30 days, corresponding to about 12½., cash, New York, but sales for export have been made in large volume at a somewhat lower price. The buying power which was reported last week has lost its force. Domestic consumers seem for the time being to have satisfied their requirements, and European buyers can only be induced to take additional quantities by being offered concessions below the ruling quotations. The trade generally has been awaiting the figures of the Producers' Association, which were published on March 10, and show an increase in the visible supplies of about 29,000,000 pounds. The publication came too late to enable a judgment of the effect on the market prior to going to press. Meanwhile prices close dull and nominal at 12¾@13c. for Lake copper; 12⅜@12⅝c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 12¼@12½ cents.

The London standard market has fluctuated within narrow limits. Considering the uncertainty which is generally felt about the future of the market, it has taken the realization of speculative holdings relatively very well. The close is somewhat lower at £56 5s. for spot, £57 for three months.

Refined and manufactured sorts we quote: English tough, £61; best selected, £60@61; strong sheets, £72@74.

It is gossiped that the International Smelting and Refining Company holds an option on the Raritan copper refinery of the United Metals Selling Company.

Copper Producers' Association—The statement for March 1 shows stocks of marketable copper of all kinds on hand at all points in the United States, Feb. 1, were 144,130,045 lb.; production of marketable copper in the United States, from all domestic and foreign sources during February, 103,700,817 lb.; total supply, 147,830,862 lb. Deliveries of marketable copper for consumption and export during February, 74,546,614 lb.; stocks of marketable copper of all kinds on hand at all points in the United States, March 1, were 173,284,248 lb. The increase in stocks was 29,154,203 lb. during February.

Tin—The market in London as well as here has been rather dull throughout the week, but retained its firm undertone. Business done was on a small scale. The London close is cabled at £130 5s. for spot, £131 15s. for three months, while New York dealers quote the market at 28⅝ cents.

Lead—Business was somewhat more active, particularly early in the week. The cheap lots of Missouri lead which were floating about the market appear to have been absorbed and holders now are trying to get an advance. The market closes steady at 3.80@3.82½c. St. Louis, 3.95@3.97½c. New York.

The London lead market has been holding steady and closes unchanged at £13 7s. 6d. for Spanish lead, £13 10s. for English lead.

There is a certain amount of truth in the report cabled last week from Paris to the *Journal of Commerce* respecting a meeting of lead producers to consider the organization of a convention similar to that which has been effected among the producers of spelter, but the plans have not yet reached beyond a general discussion. The meeting was attended by representatives of certain American smelting interests. Insofar as American production and consumption of lead are concerned, we are, of course, quite independent of European conditions so long as a tariff is maintained, but the desilverizers in this country refine a great deal of Mexican lead in bond, which is exported to Europe, wherefore the interest of American refiners in the European market.

Spelter—The brass manufacturers are reported to have placed some orders, but business for galvanizing purposes has been of a retail character. Quotations are unchanged throughout the week at 4.72½@4.77½c. New York, 4.57½@4.62½c. St. Louis.

Base price of sheet zinc is now 6¾c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

The London market is lower at £21 10s. for good ordinaries, £21 15s. for specials.

Other Metals

Antimony—The market is dull, and only a retail trade has been done. In the absence of business, quotations are nominal at 8@8⅛c. for Cookson's; 7⅞c. for Hallett's; 7⅜@7⅝c. for ordinary brands.

Aluminum—Quotations by the manufacturer here are unchanged at 24c. base for No. 1 ingots and 33@34c. base for sheets.

Quicksilver—A fair business has been done, but New York quotations are unchanged at $45@46 per flask of 75 lb. San Francisco is nominal at $45 for domestic orders and $43 for export. London price is £8 7s. 6d. per flask, with £8 6s. 3d. quoted by jobbers.

Cadmium—Currents quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States for the month of January are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	21,012	9,662	Exp. 11,350
Copper, 1908....	33,003	6,939	Exp. 26,064
Tin, long tons....	19	4,196	Imp. 4,177
Tin, 1908.....	33	1,155	Imp. 1,122
Lead, short tons.	7,465	9,966	Imp. 2,501
Lead, 1908.....	6,136	7,051	Imp. 915
Spelter, sh. tons.	364	283	Exp. 81
Spelter, 1908....	210	31	Exp. 179
Nickel, lb.....	635,576	853,630	Imp. 218,054
Nickel, 1908....	857,540	1,345,179	Imp. 487,361
Antimony, lb.....	.....	584,147	Imp. 584,147
Antimony, 1908.	.....	709,245	Imp. 709,245
Platinum, oz.....	.....	12,466	Imp. 12,466
Platinum, 1908.	.....	3,312	Imp. 3,312
Quicksilver, lb...	7,553	.....	Exp. 7,553
Quicksilver, '08	11,730	.....	Exp. 11,730
Aluminum, value	$3,583	.....	Exp. $3,583
Aluminum, 1908	5,815	.....	Exp. 5,815
Ores, etc.:			
Zinc oxide, lb...	1,639,270	.....	Exp. 1,639,270
Zinc oxide, '08..	1,072,182	.....	Exp. 1,072,182
Zinc dross, lb....	1,698,663	.....	Exp. 1,698,663
Zinc dross, '08..	3,567,134	.....	Exp. 3,567,134
Zinc ores, lg.tons	.....	9,096	Imp. 9,096
Zinc ores, 1908.	4,048	2,445	Exp. 1,603
Antim'y ores, lb.	.....	1,491,128	Imp. 1,491,128
Ant. ores, 1908.	.....	118,945	Imp. • 118,945

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 1588 tons calomine and 7508 tons other ores; against 1610 and 835 tons last year.

Zinc and Lead Ore Markets

Platteville, Wis., March 6—The base price paid for 60 per cent. zinc ore was $37.50 per ton. No premium reported. For 80 per cent. lead ore, $46 per ton was paid.

SHIPMENTS, WEEK ENDED MAR. 6

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Hazel Green.....	411,600	.....	.....
Benton.....	334,200	.....	.....
Platteville.....	324,900	.....	209,400
Cuba City.....	304,983	.....	.....
Strawbridge.....	220,000	.....	.....
Livingston.....	210,000	.....	.....
Linden.....	163,270	.....	.....
Rewey.....	44,650	.....	.....
Total.....	2,013,603	.....	209,400
Year to Mar. 6.....	19,931,189	656,180	1,699,600

In addition to the above there was shipped to the American Zinc Ore Separating Company 170,170 lb., and to the Joplin Separator Works, 319,500 lb. zinc ore.

Joplin, Mo., March 6—The highest price paid for zinc sulphide ore was $40 per ton. As high as $38 base was paid for particularly choice ore, but the bulk of better grades sold on $37@37.50 base. The low base was $35 for slimes with $35.50@36.50 paid for ores of upward grade. Zinc silicate sold as high as $25, on a base of $18@19 per ton of 40 per cent. zinc. The average price, all grades, was $34.08 per ton.

Lead advanced toward the close of the week, as the metal market improved, selling at $51, which was paid for several bins. The bulk of shipments were on a base of $48@49 per ton of 80 per cent. lead. The average price, all grades, was $48.40 per ton.

The market appeared featureless on the surface, but a strong undercurrent was noted in zinc sulphides as the week progressed. This was occasioned by the receipt of a heavy shipping order by one of the purchasing agencies. A quiet canvass was made for the ore, and most of the 1000 tons was picked up at current prices without disturbing the market.

SHIPMENTS, WEEK ENDED MAR. 6

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,442,841	896,450	$ 83,932
Joplin.....	1,758,870	316,580	40,285
Duenweg.....	1,409,230	74,410	25,366
Galena.....	738,840	59,870	13,951
Prosperity.....	503,480	137,640	12,433
Oronogo.....	658,550	.....	11,250
Spurgeon.....	473,610	85,290	9,013
Granby	523,810	22,200	8,315
Miami.....	393,640	120,380	8,066
Alba-Neck.....	431,580	.....	7,984
Aurora.....	440,050	4,240	6,194
Badger.....	272,730	.....	4,909
Carthage.....	243,580	.....	4,505
Quapaw.....	219,730	.....	3,515
Shoalsburg-Saginaw..	192,050	28,280	2,791
Zincite.....	152,870	.....	2,751
Wentworth.....	176,870	.....	2,681
Carl Junction.....	65,720	.....	1,249
Cave Springs.....	61,100	.....	1,130
Sarcoxie.....	54,000	.....	567
Totals	12,213,150	1,745,340	$250,887
Ten weeks.....	109,089,630	16,749,470	$2,399,566
Zinc value, the week, $208,202; 10 weeks,			$1,972,450
Lead value, the week, 42,685; 10 weeks,			427,116

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	.....	34.19	.....	49.90	.....
April.....	35.40	.....	34.08	.....	52.47	.....
May.....	34.19	.....	33.39	.....	56.05	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July.....	34.55	.....	31.67	.....	59.90	.....
August.....	36.53	.....	33.42	.....	60.34	.....
September..	37.63	.....	34.44	.....	54.59	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November...	39.13	.....	35.02	.....	54.53	.....
December...	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, March 10—The general market is still quiet. Though a little business is being done, consumers still seem reluctant to buy far ahead.

Copper Sulphate—Business is on a moderate basis only. Prices quoted by dealers are $4.60 per 100 lb. for carload lots and $4.85 per 100 lb. for smaller parcels.

Arsenic—Business has not been large. Sales for the week amount to possibly 100 tons, at 3c. per lb. for white arsenic.

Nitrate of Soda—Indications in this article are better, and more business has been done, the result being a rather higher price for futures. Quotations are 2.15c. for both spot and future positions.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, month of January, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	969,404	E. 969,404
Bleach, lb.....	7,510,746	.....	I. 7,510,746
Potash salts, lb..	36,785,255	458,819	I. 36,326,436
Soda salts, lb....	834,932	29,600	I. 805,332
Acetate lime, lb.	.....	6,669,062	E. 6,669,062
Nit. of soda, tons	13,180	743	I. 12,437
Phosphates, tons	150	44,185	E. 44,035
Sulphur, tons....	3,036	5,817	E. 2,781
Pyrites, tons.....	42,687	.....	I. 42,687

Estimating sulphur contents of pyrites, the total sulphur imported was approximately 20,011 long tons.

Mining Stocks

New York, March 10—The general stock markets during the past week have been irregular and rather inclined to weakness. There have been reductions in prices in a number of stocks, but some of these have recovered, while others have failed to feel the benefit of any reaction. The whole tone of the market is uncertain, and the fluctuations from day to day have had very little meaning.

In the Curb market the copper stocks have not been strong. Prices have not held their own, but have fallen whenever there was selling on any considerable scale. The market, however, has been inclined to dullness and the transactions, as a rule, have not been heavy. The Cobalt stocks have been rather stronger and more in demand than last week and have made a better showing than any other class. The Nevada gold stocks have been dull, and buying has not been at all active.

Boston, March 9—The stock market this week has had lots of ups and downs, but on the whole it has been not encouraging and rather inclined to weakness. The condition of the copper market, gold shipments to Europe and the temporary position of the banks have not tended to encourage speculation. Sales have been fair in amount, but buyers have been rather shy. Upon the whole it was a traders' market throughout.

Amalgamated was a strong feature, as usual, but has not held its own. It closes today at $67.50, which is $1.50 off from the highest of the day. The Boston specialties show no pronounced features. There was some activity in Parrot on reports that the lower drifts would soon reach the Anaconda vein. Nevertheless,

it sold off this evening to $29.75, after touching $30.50. Calumet & Arizona held around $101; Copper Range, after touching $77, lost $1; North Butte sold at $68.25, a loss of $1.25; East Butte at $14.50, a loss of 75c. today.

It is learned that the Bigelow interests received about $8,510,000 for their 125,000 shares of stock. The delivery was $2,700,000 cash, $5,810,000 in notes payable in from three to ten years. The many-times-postponed Osceola annual meeting for 1908 will be held March 11, just 10 minutes before the 1909 annual meeting.

Denver, Colo., March 6—The Denver Consolidated Stock Exchange was opened by a smoker March 2, at which the Governor of Colorado made the opening speech. The first call was held March 3. The officers in charge are determined that the most rigid rules shall be enforced in the listing of stocks, and in furnishing complete and authentic monthly reports. All kinds of stocks will be listed, but it will be of special importance to the mining industry of the State. The exchange officers and members have started with the intention of adhering to a high standard, and it is to be hoped that this will be maintained. The president is T. M. Howells, of Denver.

San Francisco, March 6—The oil companies listed on the California Stock and Oil Exchange in San Francisco paid $337,028 in dividends in February, making a total to date of $18,751,549 in dividends by those companies.

STOCK QUOTATIONS

NEW YORK Mar. 10		BOSTON Mar. 10	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine	.25	Adventure	7¾
Amalgamated	67⅝	Allouez	39
Anaconda	41	Am. Zinc	‡25
Balaklala	‡2 1/16	Arcadian	4⅝
British Col. Cop.	7⅛	Arizona Com.	35½
Buffalo Mines	3	Atlantic	‡15
Butte Coalition	22¼	Boston Con.	12
Colonial Silver	⅛	Calumet & Ariz.	100
Cum. Ely Mining	7⅞	Calumet & Hecla	630
Davis Daly	4⅛	Centennial	29¼
Dominion Cop.	⅛	Con. Mercur	‡.25
Douglas Copper	2¾	Copper Range	75⅞
El Rayo	2⅞	Daly-West	9½
Florence	3½	East Butte	14¼
Foster Cobalt	.34	Franklin	13½
Furnace Creek	.11	Greene—Can.	9¾
Giroux	8⅛	Isle Royal	28¾
Gold Hill	⅜	La Salle	14⅞
Goldfield Con.	7 1/16	Mass.	5
Granby	‡95	Michigan	‡10½
Greene Gold	⅛	Mohawk	63
Greene G. & S.	7	Nevada	18
Guanajuato	1⅛	North Butte	68½
Guggen. Exp.	181	Old Colony	.60
Hanapah	.15	Old Dominion	48
Kerr Lake	8¼	Osceola	129
McKinley Dar.	.90	Parrot	29⅞
Miami Copper	13½	Quincy	88
Micmac	1½	Rhode Island	‡4⅜
Mines Co. of Am.	⅛	Santa Fe	2¼
Mitchell Mining	⅛	Shannon	14
Mont. Sho. C.	1⅞	Superior	43
Nev. Utah M. & S.	2 1/16	Superior & Pitts.	‡14¼
Newhouse M. & S.	3⅜	Tamarack	‡81
Nipissing Mines	10½	Trinity	13
Old Hundred	⅜	United Cop., com.	12¼
Silver Queen	.64	U. S. Oil	‡29
Stewart	3/16	U. S. Smg. & Ref.	41⅛
Tennessee Cop'r.	38⅞	U.S. Sm. & Re., pd.	44½
Tri-Bullion	1 1/16	Utah Con.	39⅛
Union Copper	1	Victoria	‡4⅞
Utah Apex	6⅛	Winona	6
Utah Copper	40¾	Wolverine	147⅞
Yukon Gold	4¾	Wyandotte	2¾

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	37¾
Am. Smelt. & Ref.	81⅞
Am.Sm. & Ref., pf.	103⅛
Colo. Fuel & Iron	32
Federal M. & S.,pf.	‡80⅛
National Lead	75
National Lead, pf.	‡107⅛
Pittsburg Coal	‡10¼
Republic I. & S.	19⅜
Republic I. & S.,pf.	71⅛
Sloss-Sheffield	‡71⅛
Standard Oil	650¾
U. S. Steel	43⅞
U. S. Steel, pf.	110⅛
Va. Car. Chem.	43⅛

BOSTON CURB	
Ahmeek	145
Black Mt.	2
Chemung	21¼
Globe Con.	5
Hancock	12
Helvetia	3½
Keweenaw	‡4¾
North Lake	‡7⅛
Ojibway	14⅜
Superior & Bost.	‡15⅛

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Feb. 27

N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.05	.03
Center Cr'k	1.50	1.25
Cent. C. & C.	80.00	78.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	105.00	100.00
Columbia	7.00	4.00
Con. Coal	20.00	19.00
Doe Run	115.00	100.00
Gra. Bimet.	.25	.17
St. Joe	12.00	11.00

LONDON Mar. 10

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 2 9
Camp Bird	0 15 6
Esperanza	2 16 3
Tomboy	0 18 9
El Oro	1 3 9
Oroville	0 10 3

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Mar. 3.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.06
Belcher	.33	St. Ives	.12
Best & Belcher	.36	Triangle	.02
Caledonia	.09	BULLFROG STOCKS	
Challar	.09	Gibraltar	.04
Comstock	.26	Homestake King	.04
Con. Cal. & Va.	.36	Mont. Shoshone C	1.62½
Crown Point	.35	Tramp Cons	.06
Exchequer	.25	MISCELLANEOUS	
Gould & Curry	.13	Bonnie Clare	.03
Hale & Norcross	.18	Lee Gold Grotto	...
Mexican	.69	Nevada Hills	1.12½
Ophir	1.20	Nevada Smelting	1.00
Overman	.14	Nevada Wonder	.85
Potosi	.10	Nevada-Utah	2.75
Savage	.16	Penn-Wyoming	.03
Sierra Nevada	.26	Pittsburgh S. Pk.	.70
Union	.25	Rawhide Coal	.49
Utah	.02	Round Mt. Sphinx	.05
Yellow Jacket	.37		
TONOPAH STOCKS			
Belmont	.78		
Extension	.68		
Golden Anchor	.01		
Jim Butler	.14		
MacNamara	.30		
Midway	.20		
Montana	.70		
North Star	.02		
Tono'h Mine of N.	6.62½		
West End Con	.30		
GOLDFI'D STOCKS			
Adams	.02		
Atlanta	.11		
Blue Bell	.03		
Booth	.16		
Columbia Mt.	.10		
Comb. Frac	1.00		
Con. Red Top	.07		
Cracker Jack	.02		
Dia'dfield B. B. C.	.06		
Goldfield Belmont	.04		
Goldfield Daisy	.53		
Great Bend	.17		
Jumbo Extension	.10		
Kendall	.05		
Lone Star	.04		
May Queen	.03		
Oro	.08		
Red Hill	.06		
Roanoke	...		
Sandstorm	.10		

COLO. SPRINGS Mar. 5

Name of Comp.	Clg.
Acacia	6¼
Black Bell	....
C. C. Con	3⅜
Dante	‡6¼
Doctor Jack Pot	8
Elkton	71⅛
El Paso	50
Findlay	15
Gold Dollar	13
Gold Sovereign	3⅛
Isabella	25½
Index	....
Jennie Sample	8½
Jerry Johnson	6¼
Mary McKinney	35¾
Pharmacist	‡3¾
Portland	1.01
Un. Gold Mines	5
Vindicator	75
Work	7¼

Assessments

Company.	Delinq.	Sale.	Amt.
Atlantic, Ida	Feb. 20	Mar. 22	$0.00½
Belcher, Nev	Mar. 10	Mar. 31	0.10
Bullion, Nev	Feb. 24	Mar. 18	0.05
Caledonia, Nev	Mar. 16	Apr. 16	0.05
Challenge Con., Nev	Mar. 19	Apr. 9	0.05
Con. Cal. & Va., Nev	Mar. 23	Apr. 13	0.25
Crater, Ida	Feb. 23	Mar. 27	0.001
East Hercules, Wash	Feb. 15	Mar. 15	0.00½
Lady Washington, Nev	Feb. 19	Mar. 12	0.05
Little Chief, Utah	Feb. 23	Mar. 16	0.01
North Franklin, Ida	Mar. 15	Apr. 15	0.005
Overman, Nev	Feb. 18	Mar. 11	0 00
Reindeer, Ida	Feb. 15	Mar. 15	0.10½
Socrates, Cal	Feb. 15	Mar. 15	0.20
Spanish Ridge, Cal	Feb. 11	Apr. 10	0.03
Temple, Ida	Feb. 22	Mar. 15	0.006
Utah Arizona, Ariz	Feb. 25	Mar. 18	0.001
Yellow Jacket, Nev	Mar. 17	Apr. 24	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	.....	25.570	.....
April	54.505	.....	25.133	.....
May	52.795	.....	24.377	.....
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.769	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	61.197
February	12.905	12.949	13.098	13.295	58.786	57.868
March	12.704	.....	12.875	.....	58.761	.....
April	12.743	.....	12.928	.....	58.331	.....
May	12.598	.....	12.788	.....	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	.....	September	28.815	.....
April	31.702	.....	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	.....	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	.....	.....	13.975	.....
April	3.993	.....	.....	13.469	.....
May	4.253	.....	.....	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.447	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	.....	4.527	.....	21.075	.....
April	4.645	.....	4.495	.....	21.344	.....
May	4.608	.....	4.458	.....	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.